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Repairing London's Omnibuses

By I. WILLIAM CHUBB
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The conclusion — Machines for grinding in valves — Assembling the motor — The conveyor system — Final tests must be satisfactory to the police department

FOR GRINDING in valves, both two and four spindle machines have been designed to copy hand operation. The spindles have screw-driver ends which turn the valves first in one direction and then in the other, a floating and reciprocating rack at the top providing the twisting motion and continually altering the position of reversal of rotation. In order to insure that the grinding material may be distributed properly, the valves are lifted mechanically once in 10 rev., the spindle speed being 100 r.p.m. and the lift about 4 in. The valve faces are themselves ground in an Oakley grinding machine, where the valve spindle is held in a drawback collet.

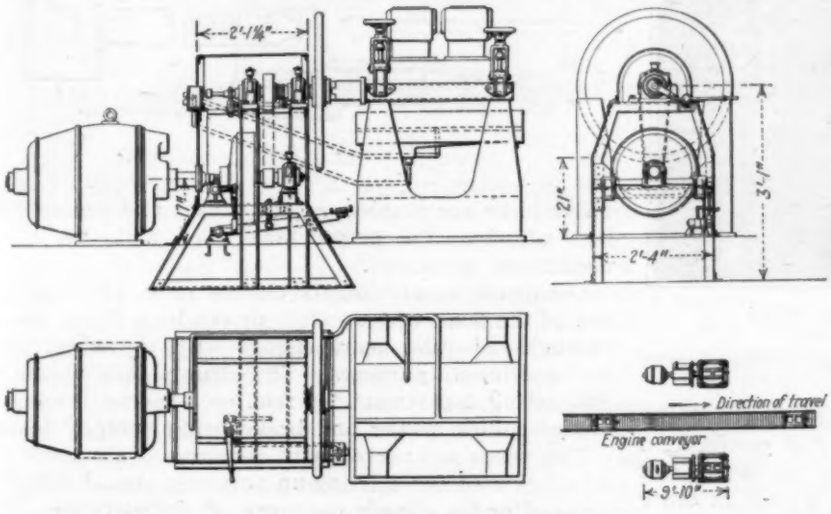


FIG. 14—ENGINE RUNNING-IN STAND

The crankshaft having been removed from the crankcase in which it has been run, the connecting rods are fastened on, having been previously assembled with their pistons as a sub-assembly. The crankcase then starts its first operation on the assembly conveyor, along which it gathers its components. Traveling at 6 in. a min., this conveyor (120 ft. long) gives 20 min. for each of the 12 assembly stages or a total of four hours for the complete crankcase. The reciprocating parts all being added, half-way up the conveyor the crankcase is taken off by a pneumatic hoist for running-in. The machine used (Fig. 14) consists of a casting with four uprights on which the engine is clamped, the driving medium being a 30-hp. electric motor with single-phase clutch and silent chain. The overhead shaft, mounted on roller bearings, is splined and carries a sliding toothed dog controlled by lever for coupling or uncoupling the engine and the motor. This shaft carries a 3-ft. cast-iron wheel to give a flywheel effect in the running in operation; it also carries a universal joint which, besides allowing angular motion, permits vertical and horizontal want of alignment to the extent of ⅜ in. each way. The engine is run in at 400 r.p.m. The flywheel enables the operator to rotate the crankshaft by hand and thus ascertain whether the bearings are sufficiently free. The engine runs in a bath of oil, a ¾-in. Albany gear-pump delivering oil at pressure through jets on to the crankshaft journal. All engines remain on the stand for 40 minutes.

The engine passing back to the conveyor, in due course the auxiliary components, including carburetor, magneto and dynamo, are added. If the engine fails to pass the running test

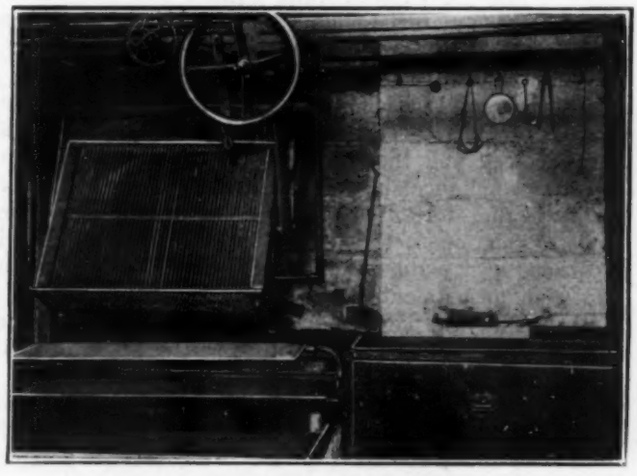


FIG. 15—ACID- AND METAL-DIPPING BATHS FOR RADIATORS

it is rectified on the stand, the next engine being tested on another stand, but as a rule only one test stand is in use. If the defect is very serious, the engine is transferred to a special rectification bench so as to prevent interference with the flow. The complete overhaul of the engine takes 29 hr., compared with 85 hr. before the use of this central repair shop.

Radiators have the top and bottom tanks removed; defective tubes are taken away and the tube center is dipped in a caustic soda solution and then immersed in Pluperfect fluid, a special preparation for removing dirt and scale from the inside of the tubes. The tube center is then rinsed in flowing cold water, again in boiling water and placed on a conveyor by which the parts are taken to a bench where new parts are fitted and soldered. Soldered joints are cleaned in spirits of salts and then dipped in molten solder. The complete block is tested for leakage by air at about 4 lb. per sq.in. and the aluminum tanks, having been cleaned with acid are refitted, the time taken being 20 min. Fig. 15 shows the acid and metal-dipping baths. The parts are conveyed from one bath to the other by the overhead gear shown.

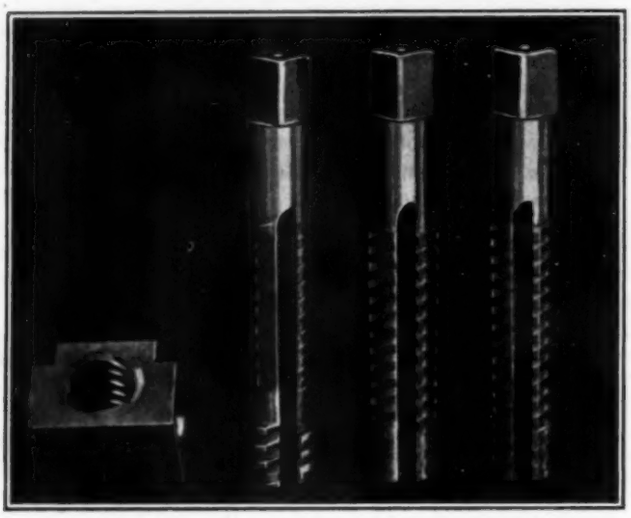


FIG. 16—TAPS FOR RECTIFYING NUTS

The phosphor-bronze nuts which form part of the steering gear have square threads. For rectification purposes the taps shown in Fig. 16 are put through in a bench operation. The first tap has a pilot in order that it may be entered quite square and the cutting edges remove material equally on each side of the thread from which half a mil is removed. Three taps form a set and they cut in steps as to depth of thread.

The correct location of the key-way in the steering fork is of importance as twist in one direction gives an off-side lock and the other a near-side lock. The indicating appliance shown at *A* in Fig. 17 with the fork below is therefore used to test the accuracy of the keyway in relation to the fork. The latter is clamped in position by a plate, as illustrated at *B*, wedges giving sidewise adjustment between the forks. A feeler is drawn along the keyway and actuates a pointer which moves over a quadrant, magnifying the angle of twist by eight.

Any difficulties experienced in removing faulty ball races from the magnetos are avoided by the use of the extractor illustrated in Fig. 18. The internal gripping piece has a radius at the front end, turned to the same size as the ball race. The ball race is gripped by turning a knurled nut and then removed by the central screw, acutated by a tommy bar.

FIG. 17—APPLIANCE FOR TESTING KEYWAY LOCATION

Final Chassis Work

The final operations on the chassis are done at the traveling platform. Both sets of axles complete with springs and wheels are positioned on the track and the chassis frame is lowered from an overhead runway and bolted up. Next the gearbox and rear carden shaft are added, together with the pedal and brake gear, steering gear, engine and clutch, radiator, dashboard and bonnet. A squad of men is allotted to each unit. Finally, the water pipes are coupled up, the brakes and engine control adjusted, the petrol tank filled and the whole mechanism lubricated.

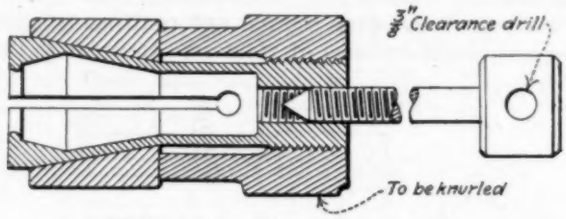


FIG. 18—BALL-RACE EXTRACTOR

Completely assembled, the chassis (Fig. 19) is at the end of the float, where rollers driven by a 23-hp. motor through reduction gears engage with the wheel tires for starting-up purposes. The chassis then passes to the testing department for trial on a special track, the engine-pulling power and brake being severely tested.

The shops are served with compressed air at 80 lb., which is used for starting-up purposes, should difficulty arise after the chassis has come off the platform. The compressed air motor (Fig. 20) runs at 400 r.p.m. and is geared down 4 to 1 by a Morse chain. A clutch be-

FIG. 19—ASSEMBLING CONVEYOR

tween the gears and the drive to the starting-up shaft is provided with a flexible joint to allow for differences in alignment.

Besides such ordinary purposes as working hoists, and blowing away swarf from machined parts, compressd air is employed in perhaps an unusual manner for cooling purposes when grinding chisels. Chisels, to the number of a dozen, are clamped in holders and run across a cupped wheel and a blast of air delivered on top of the ground faces prevents overheating.

After any necessary rectifications, are made, the chassis is passed over to the company's licensing department to make sure that the police requirements are satisfied. The chassis is then driven to the coach side of the building the body is mounted and the whole taken by the licensing department to the district passing-station of the police.

For obvious reasons these articles cannot deal completely with the work of the organization which includes an experimental department with two test stands having dynamometers for engine testing, where also the carburettors, magnetos, etc., are tried out; a laboratory which analyzes weekly, samples of fuel and monthly samples of lubricants from each garage and deals with test samples submitted by manufacturers to the purchasing and research departments. A department is set apart for reclaiming oil and removing dirt from the rags used both at Gunnersbury and also in all the garages. The oil is extracted by steam-heated centrifugals and allowed to run into a tank, whence it is pumped to a larger tank for rectifying purposes. The rags are then placed in a horizontal washing machine and given a hot water and soda bath. The water is extracted by a centrifugal and the rags pass to steam-heated drying machines, damp air, fluff, etc. being drawn away into a reservoir. Then loaded in sacks, the rags are ready for delivery to the garages. The average quantity dealt with is about 2,500 lb. a day, from which nearly two barrels of oil are extracted.

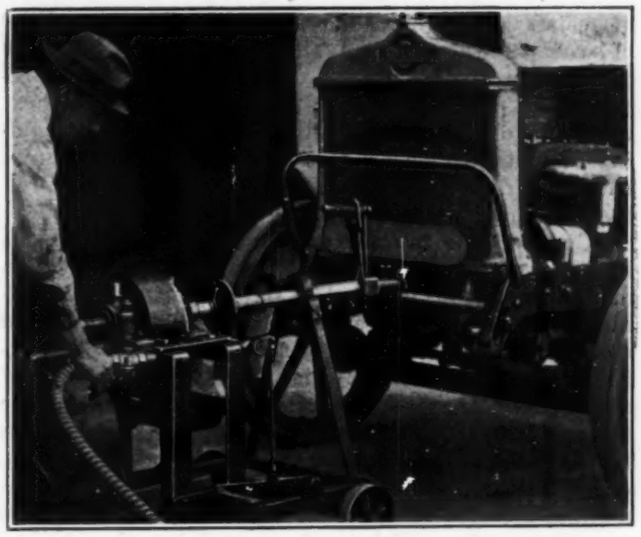


FIG. 20—STARTING-UP APPLIANCE

Investigation of the Fatigue of Metals

FATIGUE of metals has caused an estimated loss of millions of dollars annually to American industry, according to a report to the Engineering Foundation and the National Research Council by Prof. H. F. Moore, who has been conducting an investigation at the Materials Testing Laboratory in the University of Illinois. The investigation, which deals with the economic aspect of metal fatigue, has been in progress more than three years. Professor Moore's report in part states:

"Any estimate of the financial loss caused by fatigue failure of metal parts must be very rough. In general, the principal cost of fatigue failure is not caused by spectacular disasters, but by large numbers of minor accidents which necessitate replacement of broken parts, and which put machinery out of commission for a time.

"Fatigue failures are not uncommon in: Rails, car and locomotive axles, crank shafts and steering knuckles of automobiles, wire cables, steam turbine blades and discs, shafting, springs, rock-drill rods, and deep-well pump rods.

"In estimating the damage done by such failures probably the largest item of cost is the loss of service caused by idleness of machines during the replacement of broken parts. A detailed study of the above causes of failure would in itself be a considerable investigation, but it does not seem unreasonable to estimate that the total loss per year due to the above causes is several millions of dollars. It would seem that a careful study of the phenomena of fatigue failure might reduce this loss at least 50 per cent.

"This study would cover not only the properties of ferrous metals, but would also include a study of the stresses set up in parts with irregular shapes. The loss by actual fatigue failure is, however, only one phase of the problem. Another phase, probably of equal financial importance, deals with the possibility of using in stress-carrying machine parts metals which are not used now because their fatigue resisting properties are not known."

Two illustrations of the latter statement are given by the report as follows:

"It would be very desirable in many cases to use non-corrosive, non-ferrous metals for making steam turbine blades. At the present time the fatigue-resisting properties of non-ferrous metals are almost entirely unknown, and, as a turbine blade is subjected to prolonged fatigue stress, the non-ferrous turbine blade has a rather limited use. A study of the fatigue resisting properties of non-ferrous metals might enable a great saving to be made in the cost of operating steam turbines to be made.

"The use of steel castings to replace expensive steel forgings is becoming more and more common. One of the great drawbacks to the use of steel castings is a lack of knowledge as to their fatigue-resisting qualities. It is a well-known fact that a steel casting with the same chemical composition as a steel forging may have quite different strength properties. A study of the fatigue strength of steel castings offers a promising field for the further extension of the use of steel castings and for the reduction of cost of complicated steel parts."

Detailing the progress of the investigation, to answer the question "Do metals get tired?" the report continues:

"During the past year the investigation of fatigue

of metals has been in full progress. The main lines of work covered are: (1) The investigation of fatigue of wrought ferrous metals under cycles of stress repeated but not reversed, (2) study of the effect of heat treatment on fatigue strength of steel, (3) the obtaining of further evidence for the existence of a definite endurance limit for wrought ferrous metals and (4) the beginning of work on non-ferrous metals.

"Under (1), a fairly extensive series of experiments has been made, a tentative formula developed for various ranges of stress, and a second series of experiments begun. These experiments have involved the design and construction of a new type of fatigue testing machine. Under (2), heat treatment surveys of several steels have been carried out, including fatigue tests. Under (3), additional long time test data have been accumulated including one test of steel carried to one billion repetitions. There have been observed a distinct increase of endurance limit in steels subjected to millions of repetitions of stress below the original endurance limit. Under (4), fatigue tests on monel metal are now in progress.

"During the year the investigation has been financed almost entirely by the contributions of the General Electric Co. Contributions from the Allis-Chalmers Co., the Western Electric Co., and the Copper and Brass Research Association have just become available, and a study of fatigue failure of non-ferrous metals will be a major feature of the investigation in the immediate future."

Reports of the progress of this investigation have been given in Bulletins 124 and 136 of the Engineering Experiment Station of the University of Illinois and in Publications 4 and 6 of the Engineering Foundation, 29 West 39th Street, New York.

Getting Men for the Machine Industry—Discussion

BY HERBERT D. HARPER

ON PAGE 685, Vol. 58, of the *American Machinist*, A. W. Forbes states in his reply to my previous article with the above title, "that employers ignore vocational and trade schools because they know who will make desirable employees." He intimates that the vocational school graduate is not a desirable employee. This has not been my experience, for some employers do take graduates. In one particular school, the employment directors of several large machine plants have come personally to the school to sign up every graduate.

Moreover the report of the apprentice commission of the New York Building Congress states in part in the *New York Times* of April 22, 1923:

"Classes have been established in the various evening public vocational schools where apprentices are required to attend two hours a night, two nights a week. School attendance cards are punched by the instructor every night the apprentice attends. The apprentice must show this card to his employer, the financial secretary and business agent of the union when called upon. Wage increases depend upon the work of the boy on the job and in the school."

Evidently these employers after a thorough investigation came to the conclusion that the vocational schools could teach their apprentices something.

The reason some employers do ignore vocational schools is partly due to their ignorance of what the schools teach and the purpose for which they were established. This is a poor policy on their part for of all public schools, the vocational type is most nearly allied to industry as their object is the preparation of boys for trade work. If a boy does not attend a vocational or high school what does he do between the time he finishes grammar school at 13 or 14 years of age and the time nearly all states allow him to go to work—16 years? Does Mr. Forbes mean that a boy who carries messages and runs errands during that period is better fitted to be a machinist than the boy who attends a vocational school and becomes familiar with at least some tools?

THE PURPOSE OF VOCATIONAL SCHOOLS

The establishment of vocational schools was the result of a shortage of skilled men in all industries. In 1900 there were few apprentice courses in any factories, the average manufacturer being too indifferent or parsimonious to train boys. They did not want to be bothered with them and those few that did have good apprentice courses charged tuition.

In order to provide a place where every boy can have the opportunity to learn a trade, state and Federal authorities have in co-operation with city school boards, granted funds for the training of boys in various trades most prominent in the different communities.

That the product of the different schools will vary is to be expected, for some localities are more liberal with their expenditures than others. In the long run the community receives the kind of education they pay for, and if the material and equipment are lacking, a poorly equipped student will be the result. I remember in one school where I was teaching machine shop practice, not a piece of stock was given out in over a year. In order to keep the machines running the students were sent over to a nearby dump and told to pick up stray pieces of metal. Would you put the blame on the school for a poor product in this instance, Mr. Forbes, or should the blame be placed on those taxpayers, generally the big ones, who always want the budget "cut to the bone" and then send their children to a private school?

Judging from Mr. Forbes statement "that two of the instructors came to see if the work he was offering to the boys would not be satisfactory for them," such a condition exists in his locality. For while good teachers naturally gravitate to those centers that pay a suitable reward for their service, the majority teach because they like to teach, remuneration being a secondary consideration. But poor pay in any line of business will result in a smaller and smaller number of applicants and the scarcity of machine shop recruits is in part traceable to the very small pay of a decade or two ago, when $2.50 for 9 hours was the daily union wage. There is a great resemblance between the skilled help shortage and the teacher shortage of the past few years.

Although teachers salaries have been raised and great efforts put forth to get sufficient candidates, it will be several years before the supply of teachers will equal the demand. Likewise in the machine tool industry, although wages have been raised, employers have been lax in training boys for future needs which if persisted in, will imperil the machine building industries. As the vocational schools are established with at least fair equipment and a workable program, it seems only reasonable that employers should take a larger interest in them, to the end that enough skilled help will be at the call of the manufacturer.

Power Lost in Shaft Bearings

By H. M. BRAYTON
Research Engineer, Picatinny Arsenal, Dover, N. J.

Factors affecting friction losses—Equations and chart for determining power losses—Loose and tight fitting bearings and those under uniform pressure

FRICTION losses in journals are real losses reflected in the coal or electric bills. An intelligent study of their causes and prevention may reveal that a decided saving can be realized.

The friction loss in a bearing depends upon several factors. The most important of these factors are the fit of the bearing, the metal from which it is made, the speed of rotation of the shaft, the load carried and the diameter of the shaft. Some of these factors are usually not subject to much change by the designer. For example, the rotating speed of the shaft is usually fixed by the machine speeds, although it may be found desirable to put in an extra countershaft in order to reduce the speed of a main shaft. The principle to follow is that the speed should be kept as low as possible, as this reduces the loss. The size of the shaft may also be subject to but little change by the designer, as it is determined by the power to be delivered. It may be found, however, that it is better to put in a second shaft to carry part of the load rather than to use one large shaft. The saving in power losses with the smaller shaft should be balanced against the interest charges on the extra investment for the same period of time. In this way, the best procedure to follow can be easily determined.

The fit of the bearing and the coefficient of friction are factors which play a large part in bearing design. The latter should be kept as low as possible by using the proper metal and by good lubrication in service, while the former naturally divides itself into three cases, first, a loosely fitted bearing, or one which has become so by wear, second, a perfectly fitted bearing, and a bearing which is so fitted that the pressure is uniform. The friction losses increase in these various types in the order named when all other factors remain the same.

A Loosely Fitted Journal

The sketch in Fig. 1 illustrates a loosely fitted bearing exaggerated for purposes of illustration. The shaft when at rest will be in contact with the bottom of the bearing but when rotated will tend to climb up the bearing, the amount of displacement of the line of contact depending on the speed of rotation. This change due to a varying speed is small. It is also affected by variations in the coefficient of friction.

There are three forces acting and they must be in equilibrium when the shaft is running at a constant speed. These forces are the weight of the shaft W, the reaction between the shaft and the bearing P and the force of friction F which really holds the shaft on the incline. These three forces being in equilibrium form a triangle of forces and may be represented graphically by the triangle OBA. We can then write

$$W^2 = F^2 + P^2.$$

Since $\mu P = F$

Therefore $W^2 = (\mu P)^2 + P^2 = P^2(1 + \mu^2)$

Or $$P = \frac{W}{\sqrt{1+\mu^2}} \qquad (1)$$

It is evident that the angle a is the angle of repose

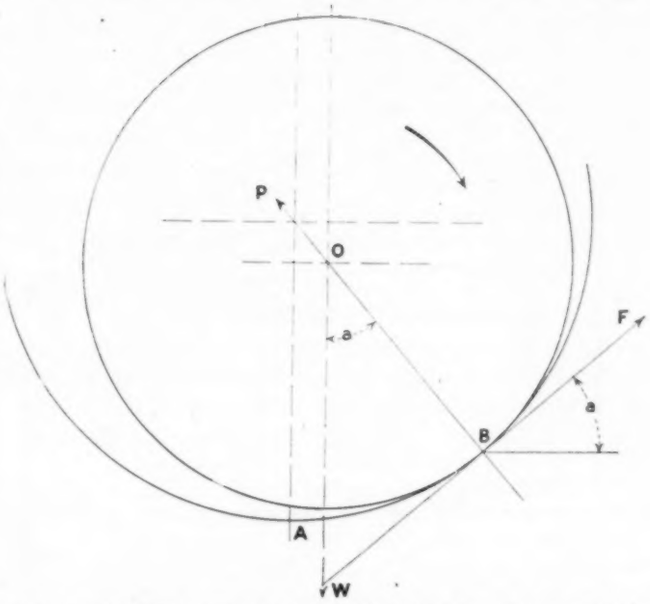


FIG. 1—FORCES ACTING ON A LOOSELY FITTING BEARING

between the shaft and the bearing and hence

$$\text{Tan } a = \mu = \text{Tan } \phi.$$

Substituting in equation (1) the value of P in terms of F and μ, and then the value of μ in terms of the tangent of the angle of friction, we obtain

$$F = \frac{\mu W}{\sqrt{1+\mu^2}} = \frac{\text{Tan } \phi\, W}{\sqrt{1+\text{Tan}^2\phi}} = W \sin \phi \qquad (2)$$

Equation (2) shows what a simple relation actually exists between the force of friction, the angle of repose and the weight of the shaft.

In the above calculation the following nomenclature is used:

W = weight of shaft in pounds
P = reaction between shaft and bearing in pounds
F = force of friction tangent to contact surfaces
a = angle shown in Fig. 1
ϕ = angle of repose.
μ = coefficient of friction

As the engineer is usually interested principally in

power loss it is best to express this friction force in terms of power. The moment of friction is

$$M = FR \quad (3)$$

where M = moment in foot-pounds
and R = radius of shaft in feet

The enery or work done is

$$E = 2\pi NM = 2\pi RFN \quad (4)$$

in which

E = energy or work done per minute in foot-pounds
N = revolutions of shaft per minute

As a horsepower is defined as 33,000 foot-pounds of work per minute, we have

$$\text{Horsepower lost in friction} = \frac{2\pi RNF}{33{,}000}$$

Or horsepower lost in friction =

$$0.00019\ RNW \sin \phi \quad (5)$$

Or horsepower lost in friction =

$$0.00019\ RNW \frac{\mu}{\sqrt{1+\mu^2}} \quad (6)$$

Equation (5) or (6) will give the actual loss in horsepower for each bearing which is loose fitting when the speed of the shaft, the weight of the shaft, the radius of the shaft and the coefficient of friction are known. The coefficient must usually be assumed. The value of the coefficient will vary greatly depending on the character of the surfaces, the kind and quality of oil used, the speed of the shaft and the weight of the shaft per square inch of contact. If accurate results are desired the engineer had better consult a hand-book table, but it will usually be sufficient to use a value of 0.05 for μ.

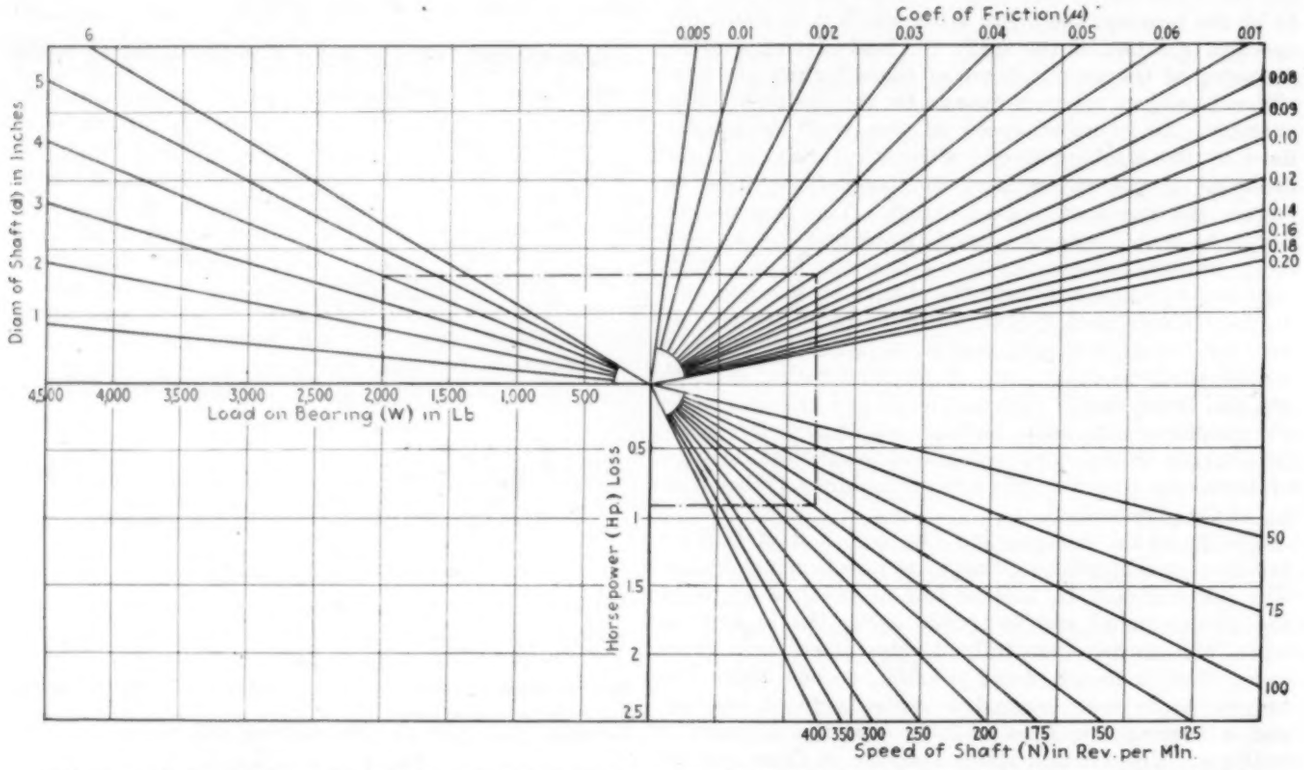


FIG. 2—CHART FOR DETERMINING HORSEPOWER LOST IN BEARINGS FROM FORMULA HP. = 0.00001245 μdNW

Tightly Fitted Bearing

When bearings are first made they will often fit nearly perfectly, in which case the load will be distributed over the entire lower surface and the intensity of the bearing pressure increases from zero at the horizontal center line to a maximum at the bottom. The calculation of the theory necessary in the determination of the friction loss in this case is somewhat complicated, involving the use of the calculus. This theory will not be given here, but the final formula is

$$P = 1.27\ W \quad (7)$$

Where P = total friction force
W = weight of shaft

Then

Lost work or energy = $2\pi RN\mu\ 1.27\ W$ in foot-pounds per minute (8)

$$\text{Horsepower lost} = \frac{2\pi\ 1.27\ RNW\mu}{33{,}000} =$$

$$0.000242\ RNW\mu. \quad (9)$$

It must be remembered that in equations (3), (4), (5), (6), (8) and (9), the value of R is expressed in feet. It will be observed that the formula given in (9) for a tightly fitted bearing is of quite a different form than the one given for a loose bearing in (6). Furthermore, it is shown that the friction loss in a tightly fitted bearing is more than in a loose one although not much greater.

When a bearing is so fitted that the intensity of bearing pressure is uniform throughout, it presents a still different problem to the engineer. The friction loss is easily calculated, but requires the use of the calculus and hence will not be derived. The formula will be given however and becomes,

$$P = 1.57\ W$$

Then, lost work or energy = $2\ \pi RN\mu\ 1.57\ W$ in foot-pounds per minute (10)

$$\text{Horsepower lost} = \frac{2\pi\ 1.57\ RNW\mu}{33{,}000} =$$

$$0.000298\ RNW\mu \quad (11)$$

It will be observed that this uniform pressure bearing gives the greatest friction loss of any of the three

cases cited. In actual practice, of course, ideal conditions either do not exist or at best exist only for a short time when the bearing is new. As a basis of comparison these formulas are of great value; and if the formula given in equation (11) is used, the designer will be on the safe side in calculating the power required to drive his shafting. The formulas are of value, therefore, not only as a means of properly designing bearings and shafting so as to keep the friction losses at a minimum, but also as a means of determining the power to allow in the motor or engine for just driving the shafting. It is an unfortunate fact that the allowance for friction is too often guessed at, which may lead directly to unnecessary expense if it is later found that the guess was wrong and the motor specified will not do the work.

The writer has charted the formula given in equation (11) in order to show how these equations can be quickly applied. This formula was selected because it represents the maximum friction loss. For convenience in application equation (11) was converted to the following inch units:

$$\text{Horsepower lost} = 0.00001245\ \mu dNW \qquad (12)$$

In which

d = diameter of shaft in inches
W = total load on bearing in pounds
μ = coefficient of friction
N = speed of rotation of shaft in revolutions per minute

The chart for this formula is shown in Fig. 2. The dot-dash line illustrates its use. If the load on the shaft is 2,000 lb., the diameter of the shaft 4 in., the coefficient of friction 0.06, and the speed of the shaft is 150 r.p.m. then the horsepower loss for each bearing is 0.9.

With the present high price of fuel the manufacturer and engineer must give more attention to friction losses in the plant. A little judicious design and study on this problem may work wonders in reducing power bills in your own plant.

Rewarding Suggestions

By A. W. Forbes

MOST of the articles appearing in the *American Machinist* on the subject of rewarding suggestions are based on the assumption that a suggestion has a value that can be at least roughly estimated. This assumption is probably true in some cases. In others it is certainly not true.

Take, for example, a suggestion of re-arrangement for machines and operations in our shop. Any experienced shop man could come into the shop and tell how the machines could be arranged to better advantage. I could do the same myself, and so could every boy in the shop. After the suggested changes had been made, there would surely be found plenty of other changes that could then be made, and this procedure would keep up forever.

In a room where one operation or a selected few are being performed year after year, an arrangement could be found that would remain for a considerable length of time without there being any evident need for improvements. In a shop like ours the character of the work changes with the changes in business conditions, and we also frequently get out new designs. If I tried to put into effect half of the possible improvements that I observed, the shop would be upset at least half the time, so that no one would learn the location of anything except what immediately concerns him in his work. Better a fair shop arrangement that is understood, than the best possible and no one familiar with it.

Suggestions for Rearranging Machines

Suppose that suggestions had been made from time to time for re-arranging certain machines, and suppose that they were all improvements, and that the time had come for adopting one. It would be foolish to look over the offered suggestions and adopt one without looking into the subject further. I would talk it over with the persons who used the machines, mentioning the suggestions that seemed good. A second interview a few days later is better than trying to decide the first time. Then we would come to a final conclusion.

Now, what is the value of the suggestion that was finally adopted? It is the saving of that method over the method that we would have come to if that particular person had not made the suggestion; but who knows what our method would have been? It might have been the same thing or even something superior.

Possibly the suggestion that the machines needed rearrangement should be given credit, but that did not have much value, especially if it had been made several times before the management decided that the time had come to make action on it profitable. The decision that the time has come for the changes is in the class of judicial decisions rather than that of suggestions.

Time for Decision

On the other hand, the decision that the time has come is often influenced by the suggestion, and I think that it should be. The fact that employees want an improvement made, is a very good reason for doing it then. It usually works better under such conditions, but here again it is not the result of suggestion. It is the result of the employees concerned coming to a conclusion, the informal conclusion being transmitted to the management by means of a suggestion from one of the individuals. It is impossible to tell which or how many of the employees are responsible.

For the last two months I have been keeping a record of the suggestions made by my employees, a thing which I seldom do and which I do not expect to continue. One of the problems to decide is, What is a suggestion? When a machinist is given a drawing with only the instructions to make a piece according to the drawing, his methods are not suggestions. If he should use a method that had never been used before in the shop for any purpose, would that be a suggestion? I do not think so, and have not included such. When we make a special machine, we talk over the general methods, and come to a conclusion as to the best methods of design and building. Fifty suggestions may be offered in twenty minutes, before anything is done toward designing the machine.

In the record below I have included only suggested changes in design of standard products, new or improved tools or machines for doing standard operations. improvement in shop arrangement including handling and storing material, and methods of sales.

RECORD OF SUGGESTIONS

Design
1 accepted, 1 postponed, 1 substituted, 1 withdrawn.
Tools and Machines
5 accepted.
Shop arrangement
3 accepted, 1 postponed.
Sales
1 accepted.

It will be noticed that the largest number of suggestions were in improvements in machines or tools for our own work, the subject in which employees would most naturally be interested. Also, that all of these improvements were accepted and put into effect at once, showing that they had received due consideration before the suggestion was made. Probably most of them had been talked over with other employees first.

Changes in design did not receive quite as ready acceptance, but in this case it must be remembered that the design of a product for sale has been thoroughly studied and tested before the machine is placed on the market.

METHOD NOT ALWAYS FOLLOWED

The results do not look as though I had followed the method previously outlined. Some items were minor and did not warrant thorough consideration. That is, they were simple things that made an evident saving, with but trifling cost; and as I did not know how much money would be made or lost by looking for a better way, I merely gave the suggestion an immediate O. K. In another case I found that it was already decided whom the men wished to do the work, as well as the changes to be made. We had to go over a few details together, and a few minor changes were made when the work was going on. The employees were performing the function of management, and all they needed was approval.

In the record just given, "accepted" means that the suggestions were accepted and instructions given to put them into effect at once, or as soon as other work was out of the way. "Postponed" means that the suggestion was good, but that it was not advisable to put it into effect at once. In the case of the one substituted. a change was considered advisable, but not the change suggested. One suggestion was withdrawn. That is, when the employee was asked how he would put it into practice, he agreed that it would not be practicable. This was the only suggestion that was entirely rejected.

Undoubtedly, more suggestions could have been secured if any effort had been made to secure more; but we do not want to make changes too fast, and I think that putting into effect ten suggestions in two months is fast enough for a shop the size of ours. A few thoroughly considered practical suggestions are worth more than any number of the kind that a casual visitor first thinks of.

HOW SUGGESTIONS ARE CARRIED OUT

In general, the person making the suggestion is given the job of carrying it out; and if he wants help on the job, he selects the man he wants, due consideration being given to regular production work. For example, if it is a special tool that is recommended, the suggestor usually makes the tool and uses it first. If a change in design of one of our products, he makes a machine or part for test, using his idea. In a shop like ours where all men are given all-around experience, it is seldom that the person making the suggestion fails to have the skill to carry it out. He is most interested in the things he can do.

No money reward is given, for I would have no idea of how to figure it, or whom to give it to. I think it is better to have one regular weekly rate, into which everything counts. We can decide with a fair degree of accuracy, what the loss would be if an employee should leave us. This scheme, of course, is not perfect, but on the whole seems about the best method of payment. The rate is revised once in three months, and everything is taken into account. The revision is almost always upward, although the change may be slight.

The Man Who Knows Why—Discussion

BY HERBERT D. HARPER

On page 734, Vol. 58, of the *American Machinist* Entropy states the advantage that comes to a man who knows why he does a certain job in a certain way. His advice about studying mechanics is good if intended for draftsmen, but I think the following subjects will help a machinist more than the study of pure mechanics.

These subjects placed in a logical educational sequence are first: a knowledge of the principles underlying the measuring instruments used in machine shop work, since without this knowledge the rest of the work is meaningless. Second: a familiarity with speeds and feeds, for every machinist should know when his machine is operating at its greatest capacity. Third: an understanding of tapers and taper turning, that is, the methods of figuring taper per foot and the tail stock offset for cutting them. Fourth: an ability to figure the depth of threads for the different standards and to find the gears required to cut them either by simple or compound arrangement. Fifth: a knowledge of simple. angular, compound and differential indexing, so as to use a dividing head intelligently. For spiral and cam milling elementary trigonometry is a necessity. After these topics have been learned, lessons in the construction of gears and the methods of cutting them, can be taken with profit.

PROBLEMATICAL ADVANTAGES

The advantages of self instruction are uncertain and generally overstated. A student may retain self-studied items longer, but he is not so likely to study systematically as when he is following a definite course and must recite at a definite time. The average individual lacks "stick-to-itiveness" and it takes a lot of sticking to learn the theory of machine shop practice without help. This leads to the suggestion that it pays to attend a school where such a course is given. There is the value derived from class room work, of orderly thinking and incentive, gained from the stimulus of healthful competition with fellow students, that brings fruitful results to those with an ambition to succeed.

In the larger cities courses in machine shop practice and theory are given in the public evening trade schools. Although these courses are free and given by expert teachers, they are not as well attended as they should be. My experience leads me to believe that the average mechanic does not want to know why and will not make any conscientious effort to help himself. If he does enroll in an evening course, the chances are 50 to 1 that his choice will be shop work instead of the class room, where he is taught why work is done in a certain way.

Machining Soft Rubber

BY E. LYTTON-BROOKS
London, England

Methods of holding rubber for machining—Tools for various operations — Precautions necessary to compensate for distortion—Cutting lubricant used

THE FOLLOWING article is intended to convey in simple, practical language the methods employed by the writer for machining soft rubber and does not pretend to deal with the matter from a scientific or commercial standpoint.

There are several essentials to be observed at all times when working rubber and they may be summed

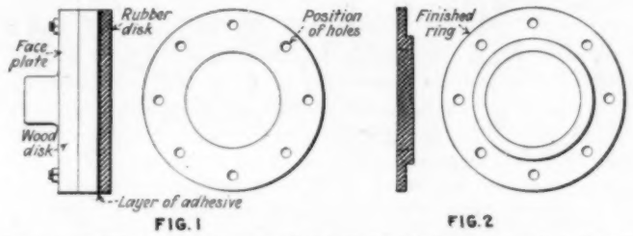


FIG. 1—HOW THE RUBBER IS MOUNTED ON THE LATHE FACEPLATE. FIG. 2—THE FINISHED WORK

as: 1—That the rubber piece to be worked on be kept clean on the working face and held as firmly as possible to the wood chuck to which it is cemented. 2—That the cutting tools be kept sharp, clean, and polished on their cutting edges. 3—That a good supply of cutting fluid be kept at the tool edge, as rubber heats the tool locally very quickly. In the cutting out of rings and disks from sheet rubber as in Figs. 1 and 2, a disk of soft yellow pine or American whitewood is secured to the face plate of the lathe by wood screws from the back, care being taken to see that the screws do not project through the wood face.

After the wooden disk has been faced true and sandpapered, the face plate is removed and the wood evenly coated with paraffin wax, a mixture of beeswax and rosin or a preparation known as Chatterton's compound, a bunsen or similar clear flame gas burner being used. When the adhesive or cement has been brought to the melting point over the whole surface, the rough cut rubber disk is pressed on evenly and kept down at the edges with a covering weight until the wax has set. The whole process is not nearly as laborious as it sounds, but like all machine work the setting up occupies most of the time.

CUTTING OUT THE CENTER

If the center of the rubber disk is to be cut out, leaving a ring for the finished piece, a good plan for the first operation is to tube drill a ½ or ⅝-in. hole in the center. Then screw in a brass wood screw, face the head off and make a very small depression in the remaining shank with a hand tool as shown in Fig. 4. This makes a firm center in which to register the divider point when laying out radii of holes that may have to be drilled.

It is not advisable to try to describe circles by bringing the divider point in direct contact with the revolving rubber, as apart from great inaccuracies, all manner of things are likely to result. Rubber is described, or defined, as a compressible fluid, so it naturally follows that great accuracy cannot be maintained, but care should be taken in the location and drilling of holes, otherwise if the rubber has to fit over studs or is to have screws passing through it, the piece will be badly distorted.

The cutting tools, a useful selection being shown in Fig. 3, are made from drill rod. Tangs may be left on to be fitted up as hand tools if desired. The tools are hardened and tempered to a pale straw. The actual piercing edges should be stoned up keen, while the edges of the fin may have a slight radius and be burnished over. Round steel tools used in a straight V toolholder in the sliderest will be found to be the most convenient, as they can be turned to conform to the circle before cutting.

Glycerine is the best cutting fluid, but if this is not available, water thickened with soap is a good substitute. The straight tool, No. 2, Fig. 3, is the one most

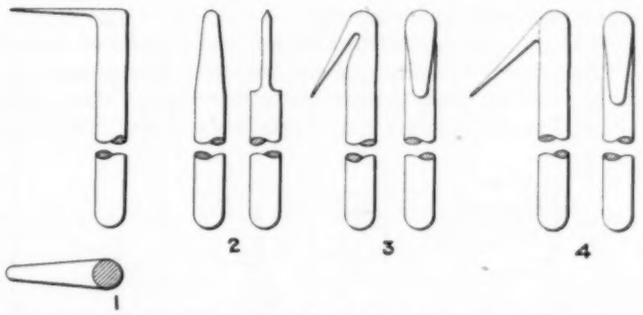


FIG. 3—SOME OF THE TOOLS FOR CUTTING RUBBER

generally used for all face work such as disks, rings and washers and also such work as shown in Figs. 12 and 14 which will be referred to later on. If holes are to be drilled in the piece, they may be set off and scribed with a pencil compass, using a moistened indelible pencil. The drilling is done with a tube drill such as is shown in Fig. 5. It is made to size from brass or mild steel. Plenty of lubricant should be used in the drilling operation. It is advisable to drill all holes with the rubber still mounted on the wood disk and, as holes in rubber cannot very well be buttoned or otherwise located, one has to get proficient with the tube cutter.

In the case of cutting out rubber disks, a good way

of setting out the cutting circle is to cement onto the center a thin metal disk, say ⅛ in. brass or zinc, and when firm, centering with a hand tool to provide a bearing for the divider point as previously outlined with the screw shank. Fig. 6 illustrates this.

The milling machine can be requisitioned when the

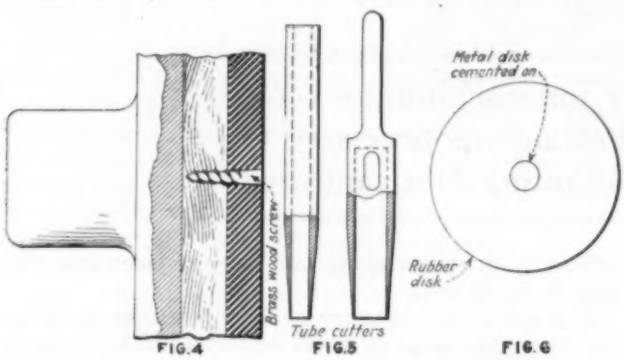
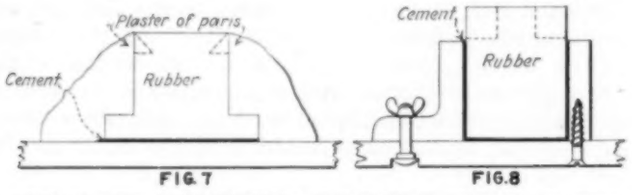


FIG. 4—BRASS SCREW USED AS A CENTER FOR THE DIVIDERS. FIG. 5—TUBE CUTTERS OR DRILLS. FIG. 6—METAL DISK TO BE USED AS A GUIDE

lathe capacity has run out and it answers quite well. A large wood disk with a stout boss screwed on may be gripped in the universal chuck fitting the spindle nose, or bolted direct onto an inserted-tooth cutter body. With the overarm pushed in flush with the column face and the cutting tool secured in the machine vise, the



FIGS. 7 AND 8—METHODS OF HOLDING RUBBER STRIPS ON MILLING MACHINE

locating and cutting out of large disks and rings is a comparatively simple matter.

For cutting rubber into blocks, strips and odd shapes to fairly accurate dimensions, both the shaper and milling machine lend themselves admirably to this work. Figs. 7 and 8 depict a job of this description. The wood backing is first planed flat on both faces, the rubber cemented on as before and given as much support as possible near the portion to be cut, but not compressing or distorting it, as the result in the finished piece may be disappointing when it is released and allowed to attain its free shape.

The dotted lines in Figs. 7 and 8 suggest the next cutting operation on these two pieces. The piece shown in Fig. 7 has been previously operated on, leaving a flange or rib on each side. After being cemented in its changed position, it is supported at the sides with plaster of paris which is allowed to set before the final cuts are proceeded with. Supporting the rubber at the sides and near the cut is to prevent its spreading while the cut is taken. As much work as possible should be done in one setting, i.e., before the rubber is pulled from its cement seating, it being quite easy to set the wood jig carrying the rubber, up on an angle plate, tool maker's knee or rotary table. Both the shaper and milling machine answer very well for cutting rubber into strips, the milling machine often having the advantage in length of traverse. The rubber sheet is secured to a board that is planed flat on both surfaces and bolted to the table. The micrometer on the cross slide can be used to space the strips.

The tools shown in Figs. 9 and 10 work very well in the shaper. The hollow tool, Fig. 9, may receive its cutting compound at the open end from where it will find its way to the cutting point by way of the two ducts shown. The disk cutter, Fig. 11, is used on the

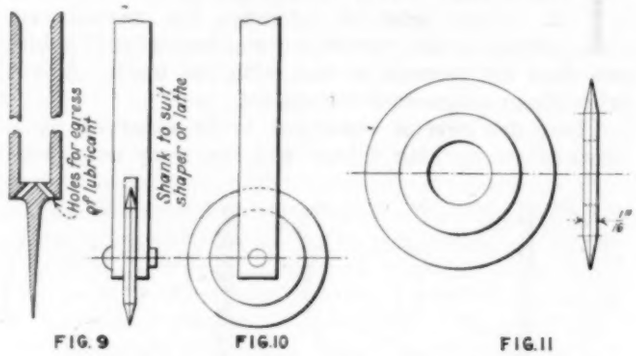
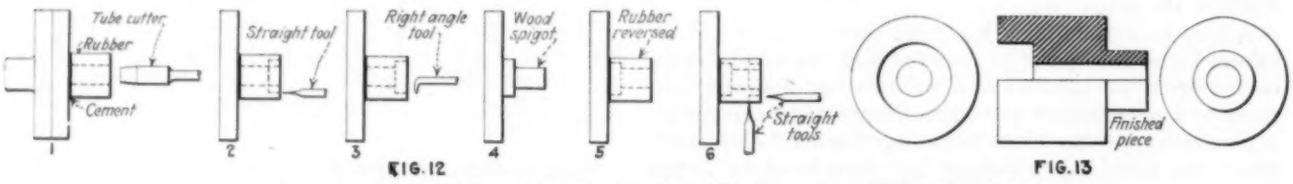


FIG. 9—PARTING TOOL FOR USE IN LATHE. FIG. 10—PARTING TOOL FOR USE IN SHAPER. FIG. 11—PARTING TOOL FOR USE IN MILLING MACHINE

milling machine arbor and is made from saw-steel hardened and ground. This type of cutter gives a very clean cut and will cut up strips quickly and with a fair amount of accuracy.

A sequence of operations on a circular piece is shown in Fig. 12 and need not be described fully. After operation 3, a wood spigot is driven into a hole previously bored in the wood disk and turned to fit the hole in the rubber easily, after which the rubber is re-cemented on and the work proceeded with. Fig. 13 is a suggestion of the finished piece.

Rubber bands in small sizes can be duplicated quickly by pushing cored rubber or tubing onto a mandrel. The rubber in this case should fit tight enough to prevent its turning under the cut and a trial band or two should be cut off and examined for width. When this has been determined it is merely a matter of spacing and parting and either the tool No. 2, Fig. 3, or the one in Fig. 10 may be used. Mandrel practice is also used for grinding rubber covered taper-plugs of special sizes, corks, etc., the bored rubber in this case being an easy fit on the mandrel and cemented in position. A Dumore, or similar toolpost grinder, with a fairly coarse wheel is used for grinding, which is done dry. If the mandrel is larger than the hole in the rubber piece, or sufficiently large to grip the rubber under grinding pressure,



FIGS. 12 AND 13—SEQUENCE OF OPERATIONS AND THE FINISHED WORK

care should be taken to remove the piece from time to time, when getting down to size and trying it into the hole in which it is to fit, otherwise it will probably be very much undersize.

Rubber pieces required in quantity are better and

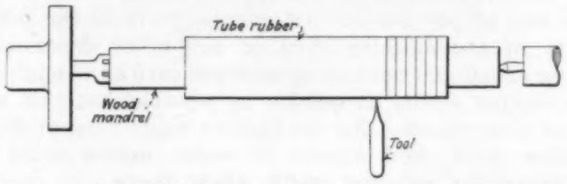


FIG. 14—CUTTING RINGS OR BANDS FROM TUBING

cheaper moulded. Also there are complicated pieces which it would not pay to make at home, but provided these requirements do not obtain, it is far easier and quicker to do the job in the shop.

Flash Welding–Discussion

BY G. A. HUGHES
Electrical Engineer Truscon Steel Company

On page 433 of the *American Machinist*, there appeared an article on Flash Welding, by A. L. DeLeeuw. Some of the figures on current consumption and welding pressure given in the article are so at variance with those obtained from many tests conducted by the writer, that there must have been some mistake in their calculation.

In the tests which are described in what follows, a watt-meter, an ammeter and a voltmeter were inserted in the line to give the power consumed in both the auto transformer and the welding transformer of the welding machine. The auto transformer had eight equal strips giving from 65 per cent to full line voltage, the eighth strip placing the welding transformer directly across the power line.

The current consumed in welding steel of various cross-sectional area is given in Table I. The pressure

TABLE I—POWER CONSUMED IN VARIOUS WELDS

Area Sq. In.	Volts	Amps	KW	PF	Time Sec.	Auto Trans. Tap
1.5	220	281	56	0.87	16	1
2.0	220	348	70	0.89	16	3
3.0	220	459	91	0.90	17	5
7.0	218	651	131	0.90	21	8

used in forcing the steel together, after it was up to a welding heat, was between 900 and 1,000 lb. per sq.in. of cross-sectional area in each case.

The results of a butt welding test on a square bar of soft steel with a cross-sectional area of 1 sq.in., are shown in Table II. Two tension tests on samples of the bar run as control tests showed failures at 51,900 and 52,300 lb. The welded pieces were machined and Nos. 1, 2 and 3 were given a tensile test, while 4 and 5 were subjected to shear at the weld. The results were as follows:

No. 1 failed in weld at 48,800 lb.
No. 2 failed in weld at 52,300 lb.
No. 3 failed back of weld at 50,100 lb.
No. 4 failed at 51,500 lb.
No. 5 failed at 50,300 lb.

Evidently, there was little difference between the ultimate shearing strength of the weld and its ultimate tensile strength.

Another series of tests were made on flat steel $\frac{5}{16}$ in. thick and 5 in. wide, butt welded. The control test of an unwelded sample showed an ultimate tensile strength

TABLE II—POWER CONSUMED IN SIMILAR WELDS

No.	Volts	Amps	KW	PF	Time in Sec.
1	220	220	40	91	15
2	220	200	40	91	15
3	220	210	39	84	15
4	218	210	39.5	86	15
5	220	210	39	84	15

of 56,150 lb. The results of six tests are shown in Table III.

In tests on a butt welding machine, an integrating watt-hour meter was inserted in the line to read the power consumed. It showed a total power consumption of 20 kw. for 164 welds on flat soft steel strips, $6\frac{1}{16}$ in. wide by $\frac{5}{16}$-in. thick. The cross-sectional area is 1.15 sq.in. This reduces to 122 watt-hours per weld, or 106 watt-hours per sq.in. of cross section welded.

The same welding machine was used to make 410 flash welds of soft steel hoops, the material being $4\frac{15}{16}$-in. wide and $\frac{5}{16}$-in. thick. The area of the welded cross-section is 0.86 sq.in., and the power consumed for the total number of welds was 68 kw.-hr., which means 166 watt-hours per weld, or 193 watt-hours per square inch of cross-section.

The reason for the greater power consumption of the

TABLE III—WELD FAILURE DATA

Test No.	Manner of Failure		lb.	Per Cent, Strength
1	½ weld—½ plate		51000	91
2	Plate		52000	93
3	Plate		53400	95
4	Plate	Just	52600	93
5	Plate	Back of	46100	82
6	Plate	Weld	51900	93

latter test is that the work being in the form of a hoop, part of the current was thus permitted to travel from one jaw to the other through the hoop rather than across the weld.

[With regard to the foregoing discussion, Mr. DeLeeuw wishes us to state that the pressures and current consumption given in the original article for ½-in. round stock should have been stated as per sq.in. of cross-section rather than as the total amount for the ½-in. stock. If this correction is made, there is not a very great discrepancy between his figures and those of Mr. Hughes.—EDITOR.]

Drawing Office Versus Machine Shop

BY F. P. TERRY

"Should the drawing office be compelled to saddle the cost of its own errors?" This question is the "bone of contention" with many machine shop men. Usually the reverse is the case, and the poor machine shop is left with all the charges set against it.

In one firm I know, if a drawing office error should result in a casting being useless, the foundry really finds this a benefit, as the faulty casting is returned to it at scrap price and a new one put in hand at the usual rates. The foundry manager declares he has enough to do replacing his own errors such as blow holes, cracks and the like, which he replaces free of charge on receiving the faulty castings.

The pattern shop loses the time required for making alterations, often only a trivial matter, but the poor machine shop loses everything, no matter how much time has been spent on the work before discovering the fault. The machineman must have his full rate of

bonus providing he is not at fault, but no allowance is made on machine shop costs to make the drawing office responsible.

In this particular firm the machine shop foreman, for his own interests, has adopted a card system showing all time wasted or lost, whatever the cause, and, while at the end of the year there is a substantial amount gone in circumstances over which he has no control, nothing is done. As all departments except the drawing office have a bonus system on output, naturally the machine shopman has a grievance. The management takes the attitude that to discriminate in this way would cause endless friction and jealousy, consequently everything goes on in the old sweet way. Mistakes in patterns or forgings are also treated the same, the departments concerned replacing free of charge, but no allowances are made should the machine shop waste days before discovering a mistake.

Personally, I think this attitude is entirely wrong, and that the tabulating and fixing of the responsibility for errors and costs would make every department take due and proper notice. Of course, there is the possibility of the machine shop or any other department going ahead and not taking as much care as it might in discovering errors as quickly as possible, but this is I think very remote. No one likes to waste time in doing useless work, and, should it occur, means could be arranged for refusing credit where there was reasonable ground for concluding that the faults could have been discovered earlier.

Heating and Brazing Torches

ALTHOUGH heating torches that use kerosene or gasoline as fuel are commonly considered to be fairly safe, serious accidents sometimes occur in connection with the use of them. Not long ago, for example, we received notice of an accident in which a kerosene blow-torch exploded, killing one man and injuring five others more or less seriously. In view of possibilities of this nature, it is quite important for every person operating a heating or brazing torch to become familiar with the apparatus he is using, and to make sure that all reasonable precautions against accident have been taken.

Many forms of heating torches are available, but they can all be included in two main classes. One class consists of those that depend upon a small hand pump for producing the pressure necessary to force the fuel up to the burner. This type includes the ordinary hand blow-torch, the tinner's or plumber's furnace, and the so-called braziers or pre-heaters. The second main class includes all torches that are operated by means of compressed air supplied from an outside source. Apparatus of this second type may be provided with a closed fuel-tank from which the fuel is forced by means of air pressure, or it may be of the aspirating or suction type, in which the compressed air is delivered to the fuel line in such a way that it draws the fuel from an open tank or container by suction.

In selecting heating or brazing torches, the construction of the fuel tank should receive detailed consideration. Most tanks are made of steel or brass, solid drawn or with double riveted joints, and appear to be built with a reasonable factor of safety. There are some types available, however, in which the tank seams are welded or brazed, and at least a few that have heavy tin plate or galvanized iron tanks and soldered joints. In considering the tank be sure that the construction is adequate to withstand the operating pressure and still have a wide margin of safety. Welded or brazed tanks should be satisfactory if the welding or brazing is well done; but soldered seams and connections should be avoided.

A check valve in the fuel line is highly desirable, because it may prevent the flame from passing back from the burner in case of very low pressure in the fuel tank. Screens or wire-gauze filters are likewise desirable in torches using kerosene and gasoline. The main purpose in using screens and check valves is to regulate the flow of fuel, but they also serve as retardants to the back passage of the flame in case it should flare back from the burner into the fuel line, and they should be considered as safety devices as well as a means of increasing the efficiency of the apparatus that is being used.

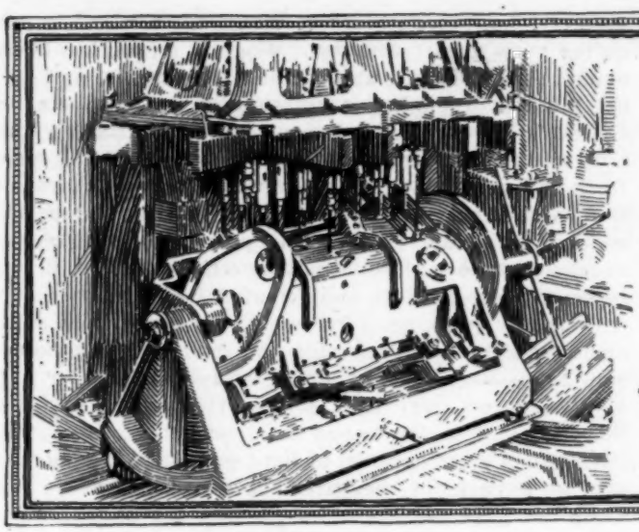
In the closed-vessel type of apparatus it is advisable to install a reducing valve between the source of air supply and the fuel tank. This valve should be set to close at not more than the maximum operating pressure recommended by the manufacturer of the apparatus, in order to protect the tank against excessive pressure. In the larger types that use compressed air from an outside source, the reducing valve should be placed between the air connection and the tank, and in the hand-pump types the valve should be located at the delivery and of the hand pump.

Pressure gages should also be provided on all closed fuel tanks, and these gages should be tested from time to time to make sure that they operate effectively. It is extremely important to know what pressure exists in the tanks at all times, and this can be ascertained only by means of an accurate pressure gage.

The fuel opening in the burner should be examined frequently to make sure that it has not become clogged with particles of dirt or other foreign matter. Sometimes when a burner has become clogged so that the fuel supply is low, the operator has concluded that the *air pressure* was low, and proceeded to operate the pump. Under these conditions the tank might give way, if the pressure were to become excessive. If the tank were provided with a reducing valve and an accurate pressure gage, however, the danger of producing over-pressure in this way could easily be avoided, since the operator may note when a high pressure is being reached.

Perhaps the most important element in the safe operation of heating torches in general is to make sure that the right kind of fuel is used. With the possible exception of the small hand blow torches the use of gasoline in heating apparatus of the types under discussion is considered too dangerous, and its use should be discouraged. We know of one instance in which gasoline was substituted for kerosene in a blazing torch, with the result that the tank exploded and one of the workmen nearby was fatally burned.

Never smoke while filling the fuel tank, and be sure that no open flame or a fire of any kind is near. Fill the tank by daylight, or if this is not practicable use an incandescent electric lamp. Always use a funnel to avoid spilling the fuel.—From *The Travelers Standard.*



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Working gage design continued—Lever and dial indicating gages—Gaging depth of recesses—Aiding production by tool-setting gages

MANY times the tolerances on work are very small, and when this condition is found the flush-pin type of gage will not always prove successful. It is desirable, therefore, to multiply the reading of the error on the work in one way or another. One of the easiest methods of doing this is by means of a pointer such as is shown at *A* in Fig. 540. The work shown at *B* can be tested for error by mounting the pointer *C* on a block *D* which has a graduated arc at one end as shown at *E*. By revolving the work with the portion *F* in contact with it, errors in concentricity can readily be noted by the fluctuations of the pointer. Also, if the block *D* is held in a fixed position in relation to the center of the work, diameter variations can also be ascertained. The proportions of the ends of the lever *G* and *H* determine the multiplication obtained.

An arrangement of this sort is frequently applied to a pin type of gage, as shown at *K*. The pin *L* may be mounted in any convienient manner, so that one end comes in contact with the lever and the other strikes the work. The lever form shown in this sample permits greater multiplication than the type shown at *C*, as it is possible to place the fulcrum and pivot point closer together. The distance *M* can be in extreme cases very short, permitting a large multiplication, according to the length of the portion *N*.

Application of Lever Indicators

When greater multiplications are necessary a combination of levers like that shown at *O* can be used. Here the pressure is applied against the pin in the direction indicated by the arrow at *P*. This pressure is transferred to the pointer *Q* by means of lever *R*. The dial or graduated arc can then be placed as shown at *S*, and a much greater movement of the pointer on it is obtained. There is considerable latitude permissible in the design of lever indicators, but there is one point of importance to which the designer's attention should be called. It is usually advisable to protect as much of the lever as possible, on account of the fact that it is delicate and easily injured. It is well to place a cover over all of the lever possible, simply leaving the end of the pointer protruding.

In order to illustrate the application of lever indicators to a concrete example, we have shown a simple form in Fig. 541. Here the work *A* must be gaged from the surfaces *B* to *C*. A plain bar of steel *D* is used for the body of the gage. In this bar a hardened bushing is placed at *E*, and in the bushing a pin *F* is provided. The lower end of this pin can be fitted with a removable tip *G*, which construction permits ready replacements and also allows the gage to be used for several different depths. A plug *H* is fitted to the upper part of the pin, and against it a light spring thrusts, as is shown at *K*. An angle plate which is graduated as

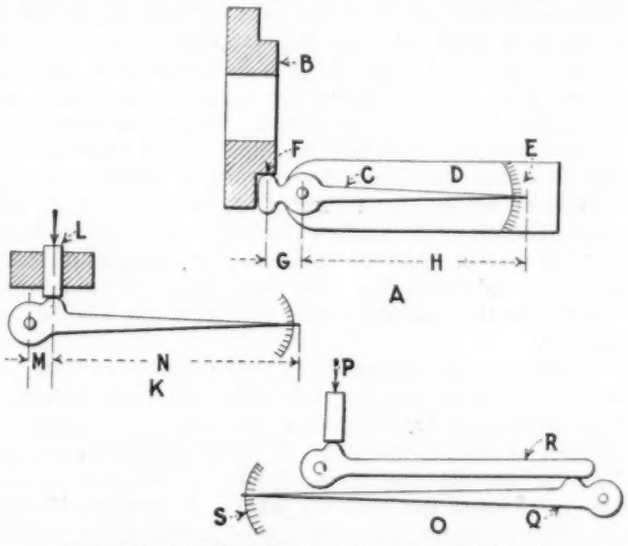


FIG. 540—PRINCIPLES OF LEVER INDICATORS

shown at *L* is fitted to one side of the base plate *D*, and on it the pointer *M* travels, thus showing the variation in the distance between the surfaces, as is desired. The purpose of the spring *K* is to counteract any lost motion at the end of the lever *M*, and the spring should be made very light so that only a minimum amount of pressure is exerted.

If a gage were required with a greater multiplication than that shown, the same principle could be used and the indicator made longer, or else the use of two or more levers might be found desirable. A caution is here given to protect the gage from damage when using lever indicators, in case the tolerances should be greatly

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exceeded, as the parts are somewhat delicate and will not stand abuse. Any simple method which will prevent the gage point from traveling through too great an arc will answer the purpose.

In connection with the use of indicator types of gages it may be found that standard test indicators can be applied in some cases, thus avoiding the necessity of

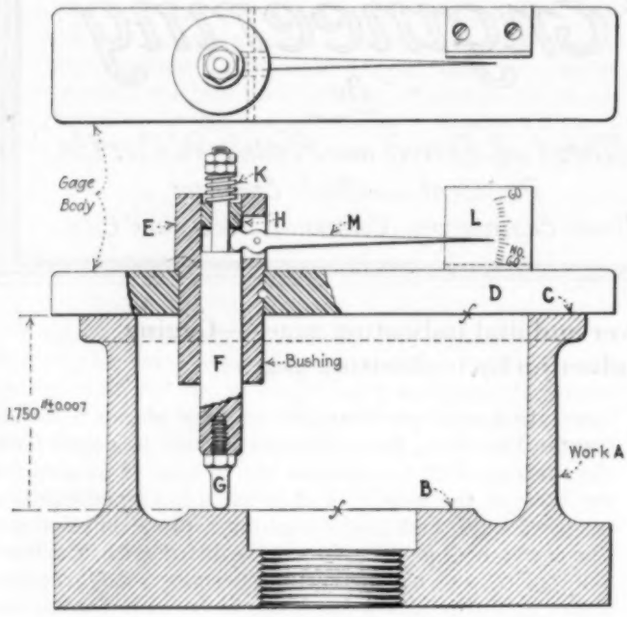


FIG. 541—APPLICATION OF LEVER INDICATOR

manufacturing a complete indicator type of gage. An example of this sort is shown at *A* in Fig. 542, in which a standard form of gage *B* is applied to a holder in which is mounted a pin *C*. The holder *D* rests against the work as shown, and the pin *C* strikes the bottom of the pocket which is to be gaged. The pin is located in a hardened bushing *E* and its upper end is connected to the indicator itself, so that errors in machining are readily shown by the movement of the pointer *F* on the graduated dial. It is often profitable to use something of this sort in order to economize in the manufacture and it is advisable for the gage designer to become familiar with standard forms which can be adapted as desired.

There is a disadvantage in using the lever form of indicating gage for general manufacturing purposes, for the reason that careless handling may result in damage to the instrument. It is impossible to provide lever gages with any great amount of tolerance if they are to be used for accurate work. Therefore, if they are forced beyond their limit they are likely to become strained and will not register properly thereafter.

The dial form of indicator gage has come into prominence and is frequently used for work requiring careful testing. A gage of this sort is shown at *G*. The dial gage is very simply mounted in a body *H* so that it can take a position with respect to the work as shown. The block H rests on the surfaces *K* and *L*, and the dial indicator pin strikes the bottom of the pocket as shown at *M*. Gages of this sort are made so that a reading of 0.0001 in. can be readily obtained. They are substantially made and have much greater latitude than the ordinary type of lever indicator.

The gaging of a recess inside of a hole is a somewhat difficult problem when the hole is very small. Fortunately, however, it seldom occurs that a recess requires very great accuracy. When a recess has been made in a hole having a diameter of approximately 1 in., the method of gaging is not greatly restricted unless the depth of the recess is considerable. Probably the best way to gage this kind of work is by means of some form of indicator which will show the amount of variation over or under the specified depth. It must be remembered that any gage for this purpose must be of the expansion type with sufficient movement so that it can be readily entered into and removed from the hole.

Generally speaking, a recess can be gaged with sufficient accuracy from one side only and it is not necessary to measure entirely across the recess diameter. In using a recess gage it is evident that the size of the hole adjacent to the recess must have been previously determined by some form of limit gage, and having this size as a basis of measurement we can develope the design of gage for the recess so that the measurement of depth will be taken from the adjacent hole.

Two forms of recess gages are shown in Fig. 543 In the example *A* the work *B* has a recess cut in it at *C*, and the hole *D* has been previously finished within a given tolerance. The bushing *E* is designed so that it will fit the hole freely, and through the center of the

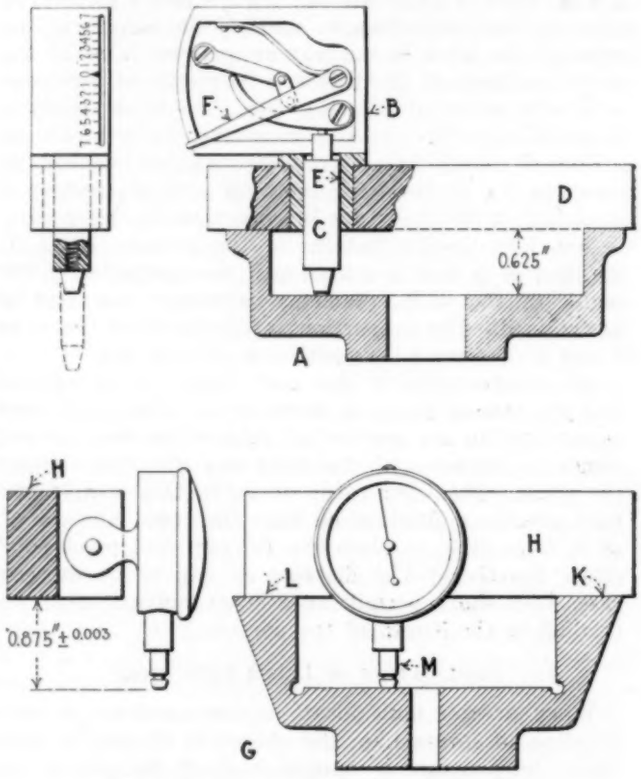


FIG. 542—DIAL AND INDICATOR GAGES

bushing a plug *F* extends as shown. The knurled collar *G* strikes against the end of the work in order to locate the bushing in its correct position. The pin *H* acts as a gage point and it is restrained by a flat spring *K*, which is slotted at the end so that it straddles the pin. An eccentric is cut on the pin *F* at the point *L*, and the movement of the gage pin is controlled by this eccentric. The graduated dial *M* is operated by and attached to the knurled handle *N* which is screwed into the plug *F*. As the handle is turned, the gage pin *H* rides on the eccentric and is controlled by it. The eccentricity of the cam must be sufficient to allow the pin to withdraw

entirely from the recess and slightly below the outside of the bushing *E*. Naturally the possibility of using a gage of this kind is dependent entirely upon the size of the hole and the depth of recess.

In the example shown at *O* a pin is used to gage the recess, but the operation of the pin is controlled in a different way from the example previously noted. The bushing *P* fits the hole in the work and through the center of this bushing the plug *Q* extends. It is a sliding fit in the bushing. The knurled collar *R* acts as a locater to obtain the correct position of the pin in relation to the recess. The gage pin *S* has a bearing on the lower end on the angular surface *T* which is cut on the plug *Q*. The movement of the pin is controlled by pushing the handle *U* in and out, and the tolerances which show the correct depth for the recess are determined by the shoulders *V* and *W* on the face of the knurled collar. A gage of this type will give good satisfaction, providing the tolerances required in the recess are not too close.

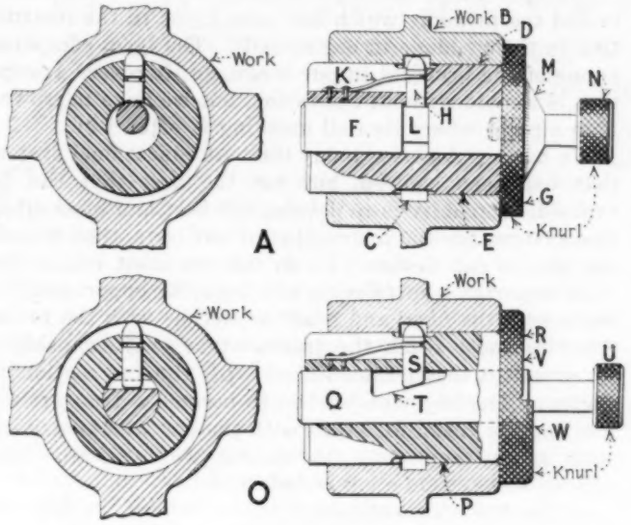


FIG. 543—TWO GAGES FOR DETERMINING DEPTH OF RECESSES

In considering work gages we should not neglect those which are used to set tools for production work. While these are not strictly work gages, they can be classified under this head as they are so closely related to it. In turret lathe or engine lathe production work and in the tooling for other varities of machine tools such as milling machines, profiling machines, gear cutting machines and grinding machines, there are many cases when tool setting gages can be used to advantage.

In a previous article under the head of Milling Fixtures we mentioned the use of set blocks in order to establish the correct setting of milling cutters for a piece of work held in a fixture. This practice is well known and universally accepted as a necessary adjunct to a milling fixture. In turret lathe work it is somewhat common practice to obtain tool settings on a new lot of work by using a sample piece which can be placed in the fixture and the tools set up to it as may be required. There are a number of disadvantages in this method of tool setting due to the possibility of changes in the method of holding, so that the work is not in its true position.

Assuming that a given piece of work is manufactured as a standard product, it is often possible to design tool setting gages which will fulfill all the requirements. Gages of this sort may be made as a part of the fixture or as a separate unit which can be placed on the fixture in a given position, and the tools set up to it.

In Fig. 544 is shown at *A* a piece of bar work, which is to be machined to the diameters *B* and *C*. The tools used for the work are indicated at *D* and *E*. In this case a multiple turning toolholder is used to locate the tools in their proper relation to the work, the general appearance of the holder being indicated at *F*. In order to set the tools to their correct position so that they will produce the diameters required, a bushing *G* is placed in the toolholder and a setting gage *H* is piloted in the bushing. The tools *K* and *L* are then set out until they strike against the two diameters of the block, at which points they are locked in position. It may be argued that this method of setting will not give absolutely correct results, due to the spring of the work away from the tool when cutting. This is very true, but the approximate locations can be so easily determined that the final setting is a simple matter of adjustment.

In the setting of cross-slide tools when special tool blocks are used, a gage may often be incorporated as a part of the tool block and excellent results obtained. There are many instances when the setting of tools in relation to each other in a cross-slide tool block causes the operator considerable trouble and uses a great deal of time. By making up a tool block like that shown at *M*, the tools can readily be set so that they will always bear the same relation to each other. The block itself is of standard form and the tools *N* and *O* are located as shown. On the block a swinging arm *P* is placed, and across this arm is a hardened gage plate Q cut away at *R* and *S* to allow for the correct setting of the tools. In use, the gage block is swung down until it rests against the pin *T*, and when in this position the tools are set and firmly locked. After setting the tools, the gage is swung back out of the way so that it does not interfere with the work in process.

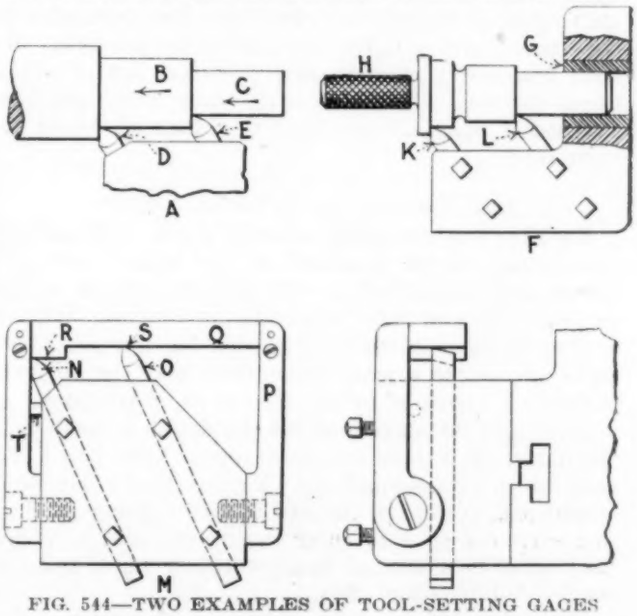


FIG. 544—TWO EXAMPLES OF TOOL-SETTING GAGES

There are many other applications which could be shown of tool setting gages, but the examples given are sufficient to illustrate the possibilities. Each designer of gages who is interested in obtaining the most efficient results both from gages and tools, should carefully consider the advisability of using tool setting gages.

Teach Your Boy a Trade

By W. H. Myers
Director, Vocational Training, R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

FROM THE days when the carpenter of Nazareth wrought with the adz and hammer in the house of his foster-father, man has been blessed in the work of his hands. Through the twenty centuries since that time the craftsman has fought his way steadily forward with the advance of civilization until today he may well be reckoned among the powerful forces at work for human progress.

The dignity of labor, for so long an empty phrase, has come to have a real meaning. More and more we in America are coming to realize that our attitude toward the occupation of the man who works with his hands must be changed.

Man must learn by doing, fully as much as he must learn by thinking. Education today is a matter of the heart and the hand fully as much as it is a matter of the mind. For the purpose of education, in all the broadness of the term, is the making of the man or woman more useful to himself and to the world. Its aim and object is to make the individual better able to care for himself and provide for his own happiness, and to benefit society generally by enhancing the value of the individual as a social asset.

The advance of our educational system has been rapid, but it has been all in one direction. Our educators striving after the literary ideal have been imbued with the classical almost to the exclusion of the practical. We have designed a magnificently decorated set of educational harness, all a-jingle with silver bells, and have clamped it upon all, thus insisting that all follow the same road.

Our Present Educational System

We have yoked together the boy whose sole ambition is to follow in the footsteps of his father, who is a doctor, and the girl whose only aspiration is to become as good wife and home maker as her mother. We prescribe the same educational burden for the youth who seeks to become a good steam-fitter and the boy who glimpses a vision of future success as an educator.

More than 90 per cent of our population is made up of the industrial worker and the farmer. Less than 10 per cent are in professional life. Yet practically our whole educational system is directed toward turning out boys and girls equipped to enter the professions, to undertake what is known as brain-work, or more aptly, to occupy "white-collar" jobs.

Educating 100 per cent of our school children along lines that fit them for the professions is plainly unjustified when we know that less than 10 per cent of them will be able to make a living in professional life. Today while our "white-collar" occupations are crowded to overflowing, we are actually lacking in skilled workmen and artisans necessary to keep up production in shop and factory and to do our structural work. Our educational system is out of balance.

We have learned that, properly trained, the American as an artisan exceeds in efficiency the natives of all other nations. Therefore we must attract young America to the crafts where men work with their hands —the crafts upon which ultimately rest the responsibility for the Nation's prosperity, economic and political. To that end we must see to it that educational conditions which induce the belief that work with the hands is irksome and menial are corrected.

Our country is spending in public funds about a billion dollars a year on education. Practically all of this money is expended by our villages, counties, states and the nation in fostering institutions which give the boy or girl academic or classical training. Very little of it, if any, is used to provide means of teaching the boy to use his hands in some useful endeavor.

The time has come to put education on a sound basis, to end the monoply which has been given to the instruction in theory alone in our schools. The term education is one of the broadest in our language; it covers a scope that is almost without limitation, but we have narrowed it to a point where its real meaning is often lost.

We have in America today the best educational system that has been evolved, but not the best that can be evolved. Our duty is to develop the best and most effective system, for the instruction of our boys, that American genius can devise. To do this we must realize the vital importance of offering our boys the opportunity to learn with the hand and heart as well as with the brain. America must teach the trades—true craftsmanship—by practical instruction linked with the instruction in theory. The boy who yearns to become a true artisan must not be yoked for years with the boy who is striving with might and main to become a physician. Our educational system must be balanced.

In the trade or vocational school, where the boy can learn a means of livelihood while he is acquiring academic learning, lies the hope of the future. Craftsmen are today a vital need of the nation. Today the natural desire of many of our young men to enter the trades is thwarted. A mistaken impression that work with the hands is to be despised, and a constant educational drift toward the office occupations drive many young men into uncongenial life-work, where they develop into mere mediocre characters or positive failures.

We must give to every American boy the training that will enable him to find out just where he will best fit into the American scheme of things. We must provide him with the mental and physical equipment necessary to fill his rightful place in the world with the best results to the individual and the nation.

System for Locating Reference Prints—Discussion

By C. W. Cyphers

Referring to the article by C. B. Johnson on page 996, Vol. 57 of the *American Machinist* on a system for locating reference prints, the use of a card to keep a record of the location of a print or drawing when the latter is in use, was emphasized. This method is good but unnecessary, as has been found in an organization employing many draftsmen and handling many prints. In the place of making out a card, have the person desiring a print write his name, date, drawing number and any other desired information on a piece of scrap paper, and put this "charge" in the place where the print was taken from. This system can be applied to any method of filing.

This method reduces errors due to the fact that there is less filing. It minimizes the cost since there is less handling, filing, record keeping and filing equipment. For the scrap paper spoken of we use the backs of internal letters and notices.

Repairing Railway Motors in Denver

BY FRED H. COLVIN
Editor, *American Machinist*

A street railway repair shop with equipment which permits efficient repairs—Running motor support bearings without machining—Convenient storage racks

THE HANDLING of street railway car repairs is very simple as compared with that of steam locomotives and there are many problems which can keep a good man constantly on the job. In too many cases the management follows the lines of steam railways and fails to provide adequate machine equipment for handling the work rapidly or economically.

The Denver Tramway Co., is an exception to this rule and as a result Master Mechanic G. W. Dolezall is able to keep the work going smoothly and economically. The machine tool equipment is good, a new car-wheel grinding machine practically completing the weeding out of the "ancients and honorables" in the machine tool line, which adorn too many shops. This grinding machine is for truing the treads of chilled car wheels by taking

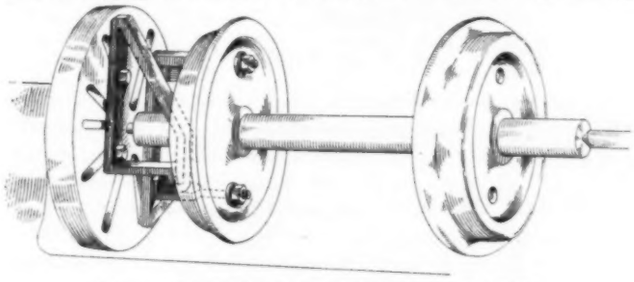


FIG. 1—TRUING CAR WHEELS IN LATHE

out flat spots and reshaping worn flanges. Where conditions warrant, worn flanges are built up by arc welding.

As there is comparatively little steel-tire turning to be done, a wheel lathe is not warranted and the work is done in a heavy engine lathe, turning one wheel at a time. In order to drive the wheels steadily, the arms shown in Fig. 1 are bolted to the face plate so that the wheel can be held firmly against them by heavy clamps, while the axle is located on the lathe centers in the usual way.

Aside from the electrical work of rewinding armatures, turning commutators and renewing field coils, most of the motor work is in replacing bearings on the armature shaft and where the axle supports the motor. The motor bearings seen were of bronze, lined with babbitt and ring-oiled. After boring, the finish is given by an internal roller, somewhat after the method of rolling car axles and piston rods in locomotive shops, except for being reversed. The hardened roller runs on the end of a bar in the turret toolpost and enlarges the bore about 0.005 inch.

The radical practice has been adopted of using the bearings that support the motor on the axle without machining. The bronze castings are carefully rumbled and cleaned, heated, dipped in acid and then tinned. Tinning ties down any loose particles which may not have been taken out in the rumbling.

If these bearings carried any kind of a load, such a method would not be practicable. But when we con-

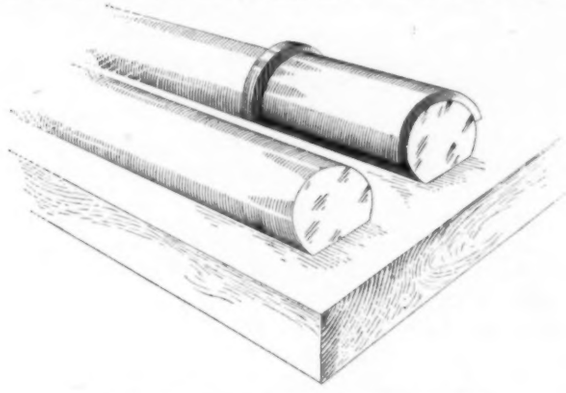


FIG. 2—METHOD OF FITTING BRASSES

sider the size of the bearings and the fact that they only carry half the weight of the motor, we see that the load per sq.in. is so light that even a twenty-five per cent bearing on the axle would be ample. The answer is that the plan works out very nicely and that the saving in bearing cost is a big item.

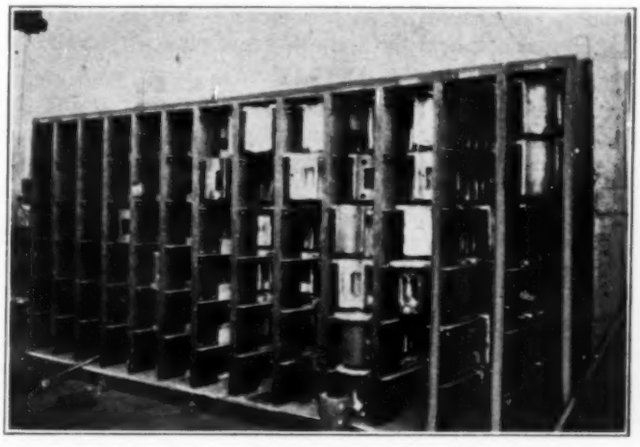


FIG. 3—RACK FOR MOTOR BRASSES

The bearings are fitted to the axles by bending the shells over mandrels made from old axles, as shown in Fig. 2. The axles are planed flat on one side to prevent rolling on the bench. The mandrels vary in size by $\frac{1}{16}$ in. and the bearing is simply bent to suit by a little

judicious hammering. It seems like a very crude method, but it works satisfactorily, which is the final answer.

The rack for keeping these and other bearings is very conveniently arranged as can be seen in Fig. 3, which shows simply a section of it. It is a wooden rack, with the verticals spaced the proper distance to admit the flanges of the bearings. The flanges are supported by angles screwed into the verticals at the proper distance apart. The rack is located within easy reach of the men doing the bending work.

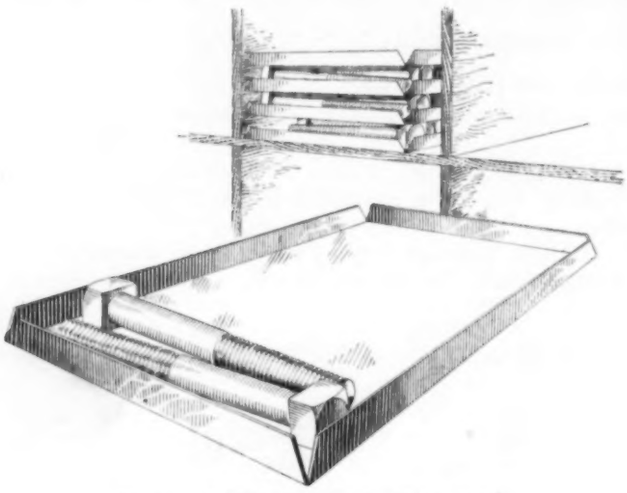


FIG. 4—STORAGE RACK AND TRAYS

The general store room is not only a model of neatness, but is laid out in a well organized manner. A little idea of this may be had from Fig. 4, which shows a section of one of the racks. A convenient feature of the system is the use of shallow metal-trays for subdividing the bins so as to facilitate counting the contents.

The trays are in reality little more than flat sheets with the edges turned up about a half inch. They are made of such sizes as to hold a definite number of parts, such as 10 or 20, of various bolts, screws or nuts, and when a tray is filled, another is placed on top of it. This enables easy counting as the contents are in multiples of the number held by a single tray, plus whatever odd number may be in the upper tray.

Refinishing Automobile Cylinders

By J. C. P. Bode

The regrinding of worn cylinders has become such a universal practice that all up to date garages consider it a part of their job either to regrind cylinders themselves or to have them reground by specialists. Approximately 90 per cent of all automobile manufacturers grind their cylinders, which proves the trend of the times.

Grinding cylinders on a rigid machine is a *corrective* method. The grinding wheel cuts a smooth straight hole regardless of hardness of material. Glazed spots often appear after boring, but such spots are ground away just as surely and rapidly as if they did not exist. This is not the case when reaming and is doubtful even when honing is used.

Another advantage of grinding is due to the design of the cylinder grinding machine. The arm carrying the wheel does not move back and forth, or up and down in sleeve-like bearings. It is sturdy and stiff and the cylinder, being clamped by its flange against a square surface will be ground dead square with this flange. The extension of the cutting wheel is always the same, therefore the side pressure is also the same at any depth of the bore. All these features add in producing a straight, round hole, absolutely square with the flange. This method *corrects* the small but important inaccuracies which must be expected in a bored cylinder.

As is always the case when a new field develops, every one likes to get into it. As a result a goodly number of special tools, from hand boring tools, reamers and inexpensive motor driven hones, to first class cylinder-grinding machines have been developed for refinishing bores. There is a place for practically all of these tools and when it is found that a bore is only slightly worn, say less than 0.003 in. out of round or tapered, a honing tool attached to a small electric motor will do very nicely. But when it comes to actually *correcting* uneven wear and being dead sure of absolute squareness with the crankcase, the old honest-to-goodness cylinder-grinding machine is the thing to use. After due investigation of the field and looking into the matter of perhaps getting other grinding jobs, many a small shop owner may find it to his advantage to add cylinder refinishing to his list of possibilities.

The Foreman and the Suggestion Box—Discussion

By W. E. Richmond

Referring to J. Homewood's defense of the retention of the suggestion box on page 737, Vol. 58, of the *American Machinist*, I fail to see where the foreman's personal opinion should be considered to have any weight from the point of view of either Frederick A. Pope, or Mr. Homewood.

The suggestion box is installed for the very purpose of providing a means for any underling to "go over the head" of his immediate superiors and communicate his ideas on any subject direct to their superiors.

Until suggestions have been adopted they concern no one, directly or indirectly, except the suggester and those appointed to consider their value. After a suggestion has been adopted, those who are to work it out—including foremen—are duly notified, it becomes a part of routine work and is on exactly the same basis as one which might have emanated from the brain of the president, general manager, or even a foreman.

Mr. Pope, like so many others, makes of the suggestion box plan a personal matter, whereas it is wholly a company matter—primarily instituted to benefit the company as a whole. A trial of the suggestion box plan soon demonstrates that it is, or is not, of value to a company. If of any value it should be developed and retained.

Because suggestions do not always receive a fair hearing at the hands of individuals—foremen or whatnot—is a principal reason why every company should give the suggestion box a trial, as by doing so it will at least do away with any possibility of a conflict between yours and the other fellow's idea of the value of your suggestion, and it will always procure for you the hearing to which, in the bottom of your heart, you think you are entitled.

Johnson Loses a Flapper Clerk

By John R. Godfrey

OLD MAN JOHNSON is a live wire for an old bird. Most of us get into ruts so deep we can't see over them and so imagine there's nothing to see. The chap who said that the only difference between a rut and a grave was the depth said a mouthful, to quote the classic language of the wife of a well-known mayor. But Johnson seems to have a sort of mental "daily dozen" which keeps him up in the band wagon. His last move is to have an employment manager or personnel director. I asked him how it happened and here's his alibi.

"I've always flattered myself with the notion I was a humdinger when it came to picking men and running a shop. But I've had a few jolts lately that indicate I'm losing my grip, that conditions have changed very materially or else that I've been kidding myself for years.

"You know, Godfrey, that I've always believed in good wages and paid 'em too, at least according to our old standards. But it's mighty hard for us old chaps to get used to modern rates and I've mussed things up a bit I guess, with some of my old fogy notions. And one of my foremen had to show me where, with all my alleged managerial ability, I was throwing away money when I thought I was saving it.

Jim Is on the Carpet

"I'd called Jim on the carpet to explain some increased costs in his department. I got the explanation all right—right between the eyes. And I flatter myself I took it like a little man; fact is I've boosted Jim's salary a bit as a result but he doesn't know it yet.

"I started in on Jim kinda fierce like, asking him why in thunder his department had balled things up so last month. Orders had gone astray and we had to hold up a shipment of motors because some of the timers were behind.

"Jim grinned and asked me if I every heard the old gag about a chain being no stronger than its weakest link and followed it up by reminding me of my failure to O.K. a raise for his clerk the first of the year.

"What's that got to do with it?

"'Everything."

"How come?

"Jim hesitated a moment and then said:

"'Well, that little flapper, as you called her when I wanted a raise for her, kept the clerical end of my department running on greased skids all the time. I know she looked frivolous, powdered her nose, reddened up her lips, frizzed her hair, wore sloppy galoshes, chewed gum and wasn't at all like the girls we used to know when we were younger. I know she didn't look as though she had two grains of sense to rub together. But I also know she kept orders straight. She was absolutely dependable and had about eleven times the brains of that young male biped you wished on me when Dora left to get a darn sight better job at more money than I asked you to give her.

"'You said Dora was only a twenty-year-old girl, she'd been here only a couple of years, she was getting more than you used to get as a real machinist, and you'd be darned if she was worth twenty-five a week to you. Then you hire a young cigarette sucking specimen of the superior sex at more than you refused her and he balls up the whole works. Dora did her level best to get him started right. She worked overtime with him and played the game square in every way. She even came over the other day in response to an S. O. S. from Percy boy, to help him out of a hole.

"'I suppose, Mr. Johnson, if I were in your place and did the actual paying of salaries and wages I might get just as near sighted as the rest of managers. But I can't help figuring it out something like this. Dora came with us two years ago, willing, hardworking and bright in spite of her following the fads of flapperdom. We spent time and money training her up to where she knew my department like a book.

"'She ordered material, checked invoices, watched time cards and gave me many a valuable tip as the result. This left me free to be really a foreman and not just a clerk with a little added authority. As a result I had time to study our work and I believe you'll agree that my department has made considerable progress during the past year.

Forgot Times Had Changed

"'Then, just because you can't forget that times have changed since you 'got fifteen a week as a real machinist,' you put a limit on what you'll pay a mere girl, no matter what she does. If she'd have been forty instead of twenty, you might have squeezed out the raise for her—forgetting that you always boast about men being paid for what they produce.

"'Our two years of training made Dora a lot more valuable. And the Brown-Smith Co. is now cashing in on it while we are trying to teach a poor prune how to do a job that Dora knew already. Not that the Johnson Motor Works is going to shut up shop because one flapper quit us cold. It'll be getting along without you and me some of these days. But you've got to show me that it's any great display of business acumen, or whatever you call it, to swap a girl who knew her job for a green ham who doesn't, and pay him more money right off the bat. Of course, we'll get someone who can do the job, but not at the price you paid Dora. And in the meantime we are delayed on deliveries, I've got to break in a new clerk and, worst of all, the Brown-Smith Co. is reaping the benefits of our training. This change has cost us more than the increase Dora wanted for the next three years.'

"Who is this Brown-Smith Co., anyhow?

"'Don't you remember? It's another product of your 'fifteen a week for a real machinist' rut. Both Brown and Smith used to work for us. Brown was a production man and Smith was in the office. Bright young chaps both of them. Got married, which takes a lot of nerve these days, and had the gall to want more money. Your old 'fifteen a week' complex stood in the way and they pulled out to start a little motor shop of their own.

"'Of course we replaced them—at a higher salary, as usual.

Salaries of New and Old Men

"'Did it ever strike you as funny Mr. Johnson, how much easier it is for a new man that you don't know much about to get a decent salary, than a man who's been with you for years? You sort of take the old man for granted and look on him as a fixture. But a new man who is able to give his own horn a bit of a toot once in a while, has no trouble at all in getting a real salary.

"'So you let both Brown and Smith go. They took with them all the training you had spent good money on. Of course, there ought to be a law to make them leave it behind, but we don't just know how to do that yet. You've not only lost them for the Johnson Motor Works

but you've got the beginning of good stiff competition by men who know how themselves and are keen enough to hire people after you've spent your good money to train 'em. They know that Dora will be worth all they pay her—and more. The chances are they'll be getting more of our organization from time to time.'

"I was sort of flabbergasted—hadn't been talked to that way for some time. Couldn't think of anything to talk about but loyalty to the company, and then Jim hit me again.

" 'Don't go to getting mushy on that loyalty stuff, Mr. Johnson,' said Jim, 'We all know loyalty and what it means. Otherwise you might not have anybody left. Your men are just as loyal to you as you are to them. After a man has worked hard for years and then sees a new man started on a similar job at higher pay, he just naturally wonders where the loyalty comes in. Loyalty isn't one sided—its got to be fifty-fifty or it doesn't last.

" 'You've been a mighty considerate boss, Mr. Johnson, and I've enjoyed working for you. And I've been just foolish enough to turn down a good offer because I like you and because I want to help your son Tom build this business even bigger than it is now. But I just couldn't help pointing out to you where you were saving dimes and losing dollars.'

"I couldn't help being a little sarcastic and said much obliged, Jim, I'll think it over and let it soak in a bit. 'Spose you think your own salary isn't any too high?"

" 'Well, I wouldn't apply for an injunction against your raising it, Mr. Johnson.'

"So you see Godfrey, Jim sure handed it to me good and proper—and the worst of it—or the best of it—is that I guess he was nine-tenths right. After thinking it over a bit I concluded that the proper thing was to get a man who was in close touch with modern shop conditions to take over this so-called personnel work. I was lucky in getting a comparatively young man who has a lot of horse sense and he's making friends in great shape. He gets on famously with the foremen and Jim is tickled silly. I'd like to see him grin when he gets his next pay envelope."

I guess Johnson's rut isn't as deep as he tried to make out. It takes a mighty nimble minded man of his age to come through on a proposition of this kind. Most of them get peeved, draw into their shells and announce that they'll run their business as they please and they'll keep right on or bust. Some bust!

Crystallization or Poor Heat Treatment?

British engineering papers are giving much attention to the report of an accident which occurred last December on the London & Northwestern Railroad. While traveling at about 60 miles an hour, a locomotive driving axle broke short off, just inside the wheel hub. An investigator for the Ministry of Transport reported that the various tests on the broken part showed that it was made from a badly segregated heat of steel. He also said that the fractured surface had the appearance common to a failure due to "fatigue."

On the other hand, a report from the National Physical Laboratory (the British equivalent of our Bureau of Standards), consulted on the case, said specifically that the test pieces had a coarse crystalline structure, and the break was a type of fracture typical of *overheated* steel.

In England as well as America there is a lack of understanding between modern metallurgical investigators and the older school of mechanical engineers engaged by railroads and other large consumers. As a matter of fact, it seems increasingly clear that a vast majority of the breaks which are commonly called "crystallization breaks" or "fatigue fractures" are due to improper refinement of the grain after the forging operation, or the entire neglect of suitable heat treatment.

The failure in question is one that it would have been extremely difficult to detect at any time subsequent to the steel making process. Segregation and piping occurred toward the axis of the piece, and the outside material, which was sampled, showed correct chemical analysis, and good physical properties.

It is to be emphasized, of course, that eternal vigilance is the price of safety. The total stress on the part which failed was not much more than 6,000 lb. per sq.in. over the whole area, which allows a factor of safety of nearly 12 for the particular steel used. This margin would certainly appear to be adequate for all purposes, and it is suggested by *The Engineer*, in the issue of May 4, 1923, that there was either an original flaw existing near the surface of the axle, or that it was scratched during machining or at some other time before the wheel was pressed on. Such surface scratches are known to be very damaging.

Selling Quality in Competition with Price

BY G. F. AHLBRANDT
General Sales Manager, The American Rolling Mill Co.

Philosophers remind us that the man who makes the best mouse trap will find the world making a path to his door. Although modern business activities prove that truthful advertising and scientific marketing guide and hasten the world's footsteps, nevertheless, the fact remains that quality goods and quality service are the ultimate desire of the vast number of intelligent buyers.

"The best is always the cheapest" is just as true today as it was when the Pyramids were erected and the Roman aqueducts were built.

Necessarily an appeal of this kind exerts a determining influence on sales organizations and marketing methods. It has forced these important adjuncts of industry to reach out constantly in new ways, to develop new avenues of approach and to originate new channels for creating business.

A quality organization is necessary to produce quality products. The efforts of the sales organization must be supported by manufacturing and producing organizations of the highest type. It is impossible to make high class products with a group of mediocre or careless men who take no interest in their work or pride in their accomplishments. To successfully market quality products, a reputation must be built up for uniformity of product and constancy of performance.

Selling quality in competition with price requires constructive selling. Salesmanship as today constituted is the result of a striking evolution. It would not be incorrect to term it a science—an exact science. The successful salesman must intimately know the products he handles; he must analyze market conditions and requirements, and he must keep abreast of the times.

Extract of paper read at National Conference of Business Paper Editors held at Middletown, Ohio.

Early Application of Multiple Stops for Turning Shoulder Work

By OSCAR E. PERRIGO

First applied in a watch factory—How the stops were made and used—Production increased—Peculiar form of lathe dog

MULTIPLE STOPS for use in turning up to several shoulders and of different diameters without removing the piece from the chuck are by no means new, and devices of many different forms have been invented for this purpose. Usually they have operated satisfactorily for a large proportion of the everyday work for which they were intended and they usually produced good work. even where a considerable degree of accuracy was required.

As to who first devised and used such stops, where they were first used and for what purposes, has caused more or less speculation and considerable inquiry among mechanical men. Perhaps the facts given in this article, reference being made to the drawings forming a part thereof and illustrating the same, may serve to throw some light on their use quite a number of years ago, and although in a somewhat crude way, the mechanical principle is shown in as practical a form as in many of the forms of the present day.

Devices for Limiting Cuts

We have authentic evidence of machinists still employed in the Pratt & Whitney shop that between the years 1880 and 1884 several devices and in various forms were made for the purpose of limiting the cuts of the different tools in the turrets of screw machines. And so far as the writer is aware, or has been able to ascertain, this was the first attempt along this line by a machine-tool builder.

It was in the seventies, more than ten years previously, that the writer, then the youngest employee in the "train room" of the old Howard Watch and Clock factory, Roxbury, Mass., made some experiments and devised and used a very simple method for successfully accomplishing the same results. His work at that time was making and keeping in order very small drills and lathe tools for a dozen watch lathes, used for making the parts of the watch mechanism. A year had been spent in acquiring some of the rudiments of watch work in this room where nearly all of the moving parts of the watch were made. The ten hours each day had often been very tedious, but fortunately the writer's work bench was just outside the shop door of Mr. Howard's private office and many a time the kindly old man would stop to drop a few words of advice, caution or instruction as to the methods of performing the work in hand, which were very carefully followed and duly appreciated, even to this day. And the boy profited not a little by this practical advice.

This company made very fine and very accurate watches, but like many of the older watch companies, seemed to be subject to sudden and periodical panics, when it was not uncommon to see a force of four or five hundred employees depleted by "laying-off" two-thirds of the entire number. One such occasion happened about the time herein referred to and all but two of the dozen girl operators of the lathes were laid off. One of these girls soon afterward married a man

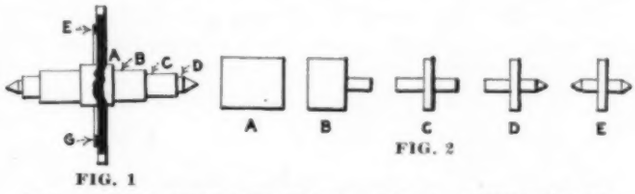


FIG. 1 FIG. 2

FIG. 1—THE FINISHED WORK. FIG. 2—SEQUENCE OF ROUGHING OPERATIONS

who spent all of his spare time for three years in trying to cut a perfect thread on a lead screw three feet long, but without success. The boy's former occupation of an embryo "toolmaker" was lost, although the financial consideration involving the munificent sum of thirteen cents an hour for ten hours a day was not great. "Piece work" was therefore suggested (and a suggestion from "the old man" was equivalent to an order). And so it was arranged that the boy should do the cutting-off, rough-turning and sizing of the "barrel arbors" on, the then, new model "L" watch. This was a "key-wind" watch and the barrel arbors carried the central hub to which the inner end of the main spring was attached. The upper end of this arbor was squared to fit the winding key and a flange near the center was cut with ratchet teeth in which the retaining pawl engaged.

Shortly before this time drop-forged parts had been tried and condemned, owing to hard surface scale and hard spots. Heat treatment was not then practiced. If it had been, the situation would probably have been saved. But it was decided to use Stubb's steel rod of a size sufficient to finish to the diameter of the ratchet disc, or about 0.31 in., and to turn down the shaft portion on each side of it. A finished piece is shown enlarged in Fig. 1.

In order to understand the work it is necessary to say that at this time diameters of watch parts were measured on a compound-lever and chain gage in the form of a caliper which divided an inch into 2,500 parts

called degrees, each of which was 0.0004 in., while lengths were measured on a vertical dial gage which divided an inch into 500 parts each equaling 0.002 in. Not a very fine system of gaging but at that time it was considered sufficiently accurate for the purposes of watch manufacture.

The first five operations are shown in Fig. 2. They compose the roughing-out process, including the initial cutting-off, for which work a seven-inch lathe in the clock department was used. For the roughing operations a discarded chuck lathe in the attic was selected because it had a very rigid chucking device similar to the present "draw-in" collet, and in addition a lever and ratchet device whereby the chuck could be closed very tightly, thus permitting quite heavy cuts to be made.

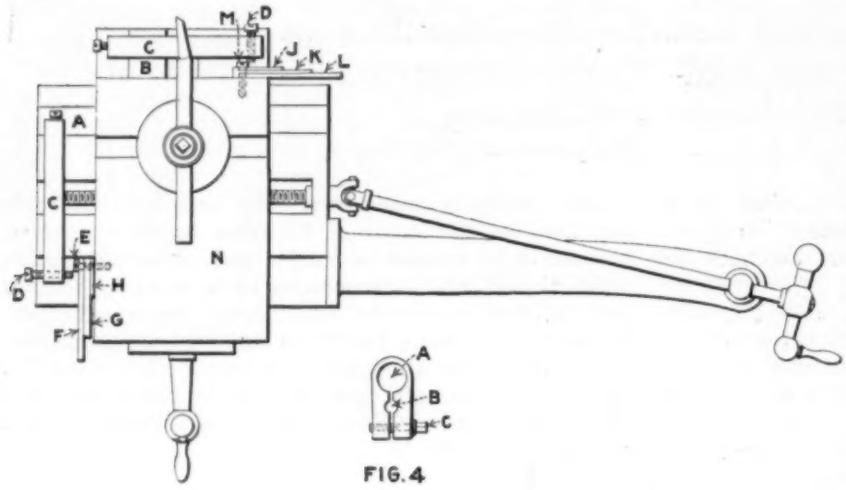


FIG. 4

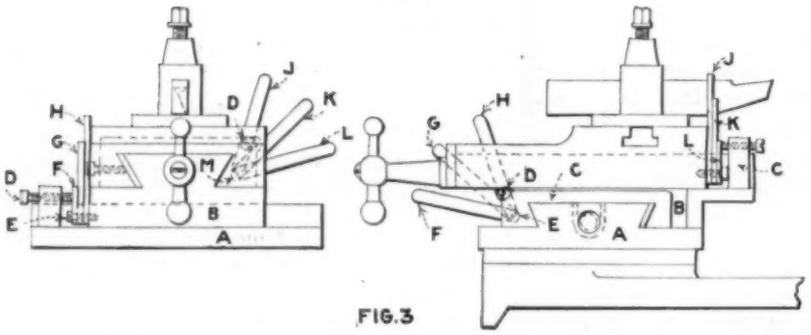


FIG. 3

FIG. 3—APPLICATION OF STOPS TO A SLIDE REST. FIG. 4—A PECULIAR FORM OF LATHE DOG

The pieces to be made were in lots of 500 at first, but subsequently increased to 1,000. When the lathe was properly adjusted for a certain series of cuts the entire lot was run through without change. The roughing cuts on these parts are shown in their proper sequence in Fig. 2. The first, of course, being cutting-off, and the fourth and fifth are the pointing operations, as all watch factory centers were female and all turned work on centers was pointed by a tool having a 30-deg. cutting edge with a very sharp top-rake. The point was finished by a tool in the tail spindle, whose cutting edge was on the center line and very carefully stoned to a 30-deg. gage having a V-bearing on the tail spindle.

In Fig. 3 is shown the compound rest fitted with the writer's device of multiple stops. Upon the dovetails of the longitudinal baseblock *A*, and the cross baseblock *B*, were originally fitted adjustable bars as at *C*, carrying stop screws *D*, which could be adjusted for turning one predetermined diameter and one length of shoulder. The problem, however, was to turn *four* diameters and up to *four* shoulders without removing the piece from the chuck. First, as to the length between shoulders. This was accomplished by pivoting upon the screw *E*, in the cross baseblock *B*, the three length-measuring levers *F*, *G* and *H*. These levers were of a thickness equal to the distance between shoulders on the piece to be made, and they were made of steel and hardened. Similar levers *J*, *K* and *L* were pivoted upon the screw *M*, in the rear end of the cross toolblock *N*, each having a thickness equal to one-half the difference in diameter of the several parts between shoulders. All of these levers are adapted to be brought up between the adjusting screws and the toolblock, or down away from such contact when they are not needed.

The method of using this device is as follows: Referring to Fig. 3, the piece is firmly held in the chuck and all the stop levers, *F*, *G* and *H*, for length and *J*, *K* and *L*, for diameter are brought up in front of the screws *D* and *D*, and the cut taken with a side tool set at right angles to the piece. Having made this cut on all the pieces of the lot the chuck is changed for one fitting the piece as shown at *B*, Fig. 2. The piece is reversed and a cut taken the same as the first, bringing the piece to the form shown at *C*. With the same chuck the cuts *A*, *B*, *C* and *D*, Fig. 1, are made as follows: Cut *A*, with levers *F*, *G* and *H*, Fig. 3, turned down and out of contact with screw *D*. This gives the proper length. Levers *J*, *K* and *L*, turned up, giving the largest diameter. Cut *B*, lever *H* up and lever *J* down, gives the next diameter and the longer shoulder. Cut *C*, levers *H* and *G* up and levers *J* and *K* down. Cut *D*, levers *F*, *G* and *H* up and levers *J*, *K* and *L* down.

For the cuts on the opposite end of the piece another set of levers of proper thickness to suit the diameters and lengths were made. The roughing operations having been completed, the sizing operations were performed with the pieces held on female centers and driven by a peculiar form of dog as shown in Fig. 4. This dog was made from a flat bar of steel, usually about 0.1x0.25 in. The hole *A*, is drilled and the end rounded as shown. In the center another hole *B*, is drilled a trifle larger than the piece to be held. A hole is drilled half way through, and the balance drilled and tapped for the clamp screw *C*. The piece is then split as shown, by which means the part surrounding the hole *A*, becomes a spring, holding the two portions apart for the introduction of the piece to be turned, which is tightly clamped by the screw *C*, operated by a steel key with a small wooden handle similar to the key used by watch repairers in the time of the key-wind watches. A lathe dog of this form is very convenient for many kinds of small work and can be very rapidly operated.

The operations of "sizing" the various parts are very similar to the roughing operations. The relief

on the left side, *E*, Fig. 1, was cut by setting the tool at an angle of 45 deg., reversing the stop bar *C*, Fig. 3, on the cross feed dovetail and fixing to the toolblock a "hook-stop," which, coming in contact with the adjusting screw *D*, limited the backward movement of the tool and the width of the friction surface shown at *G*, Fig. 1. By means of the foregoing system of multiple stops the number of operations on this piece were reduced from 33 to 16.

In order to convince the management of the practicability of this system of multiple stops, the writer was obliged to make and apply these additions to the lathe at his own expense and on this work spent a week's time for which he drew no pay, but afterward he produced a quantity of work that more than doubled his usual rate, and what was of more consequence (to the company), the work was much more uniform and in better condition for the subsequent operations of threading for the main-spring hub, cutting the ratchet and the final finishing operations.

But "this young feller is making too much money" was the official complaint, and so the "piece price" was cut and the boy indignantly rebelled, since it was his own ingenuity that produced the good results. He threw up the job and never went back to that kind of work. Thus it was that, so far as the writer is aware, the first application of multiple stops to turning operations was made, and while it was of not much consequence financially, it was another step in his mechanical education, as well as an example of the short-sightedness of the old-time management of manufacturing operations.

Heating Tires Electrically for Shrinking

By Francis P. Mann

For shrinking tires on locomotive driving wheels, a process has been developed by the Oerlikon Works, Switzerland, by which the heating is done by electricity. The process is rapid, clean and economical where current can be supplied cheaply. The illustrations show the apparatus used for electrically heating tires and other work of a like character. Figure 1 shows the heating machine in the closed position with a driving-wheel tire in place. As the machine is mounted on wheels, it can be readily transported to any part of the shop.

The machine consists of a transformer built up of laminated iron and having two vertical cores mounted on a channel bar. One core is provided with a primary coil having various terminals assembled in a small closed box. The coil is protected by a cylinder of heat-insulating substance and by a metal cover. The second core is left bare. The upper part of the transformer is so constructed that it can be unscrewed from, and pivoted about, either core for the insertion of the tire. A counterweight attached to the movable part, balances it and minimizes the power required to manipulate it.

In heating small rims or tires they can be put over the bare core as shown in Fig. 2. In heating large tires it is preferred to put them over the insulated core, resting them on a firebrick support to avoid contact with the body of the transformer, as shown in Fig. 1. The machine opened for receiving or removing small work is shown in Fig. 3. The principle involved in heating is that of the closed-secondary, the work to be heated forming the short-circuited secondary winding of the transformer, resistance to the current set up in the work causing it to heat. The heating proceeds in a gradual and regular manner and the time required to obtain the desired temperature can be easily controlled by making different connections with the various terminal contacts of the primary coil, a decided advantage in electrical heating.

When heating a tire for which the value of the current needed for the process is not known, the connections are manipulated so as to put on the smallest amount of heat, and if this is not sufficient, other connections are used until the proper heat is obtained.

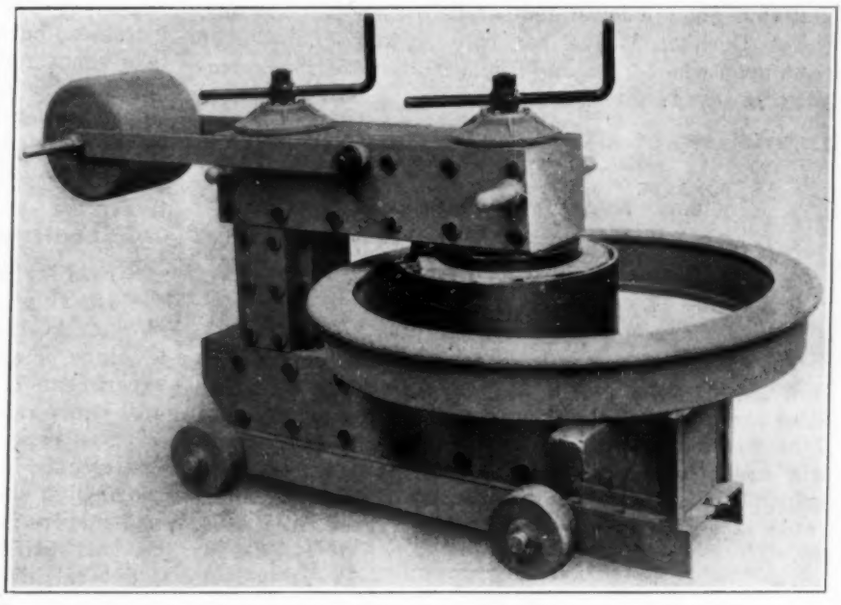


FIG. 1—TIRE HEATER CLOSED. (TIRE OVER INSULATED CORE)

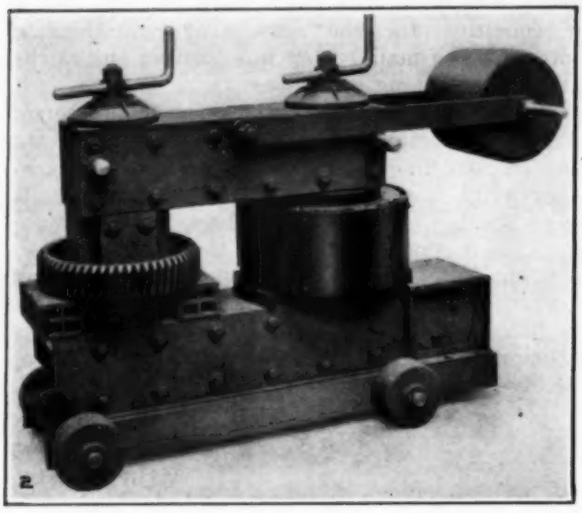
TABLE I—TESTS ON HEATING OF LOCOMOTIVE TIRES WITH AN APPARATUS USING 60 KILOWATTS (KVA), 250 VOLTS, 50 CYCLS.

DIAMETER OF TIRE, COLD, 1,689.36 MM., HOT, 1,691.90 MM. INCREASE IN DIAMETER IN 20 MIN., 2.54 MM. WEIGHT 566 KG.

Time	Amperes	Watts	Temperature
2.24	307	36,900	17 Deg. C. (air)
2.25	302	36,500	39 Deg.
2.30	291	36,500	67 Deg.
2.35	290	36,500	94 Deg.
2.40	286	36,150	119 Deg.

In European practice, the degree of shrinkage usually allowed for iron and steel is $\frac{1}{1,000}$ to $\frac{1}{1,500}$ of the original dimensions and, in order to mount a tire having about 3 ft. or less internal diameter, a sufficient increase will be 0.06 to 0.08 in. This increase corresponds to a temperature which is not high enough to have any effect on the internal structure, surface or color of the metal. Expansion is obtained in from 20 to 30 minutes.

If we calculate the expansion on the diameter of



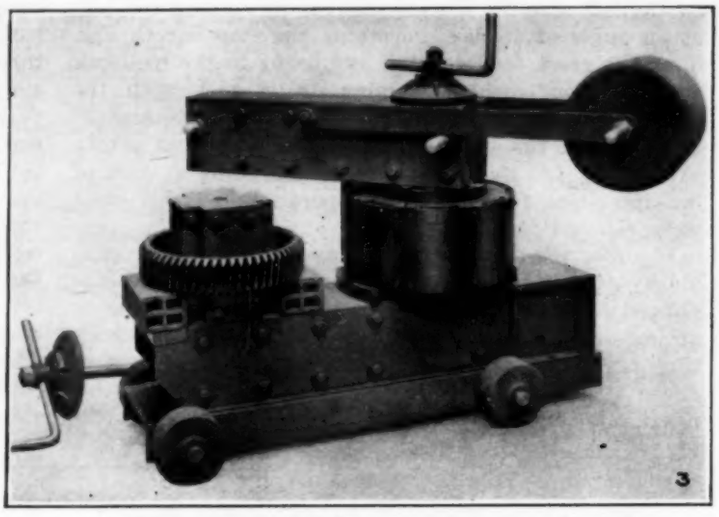


FIG. 2—TIRE HEATER CLOSED (GEAR RING OVER BARE CORE). FIG. 3—TIRE HEATER OPENED FOR RECEIVING WORK OVER BARE CORE

tires according to the expansion coefficient of steel taken as a base:

$$\beta = \frac{0.011 + 0.00008 \times t}{1{,}000}$$

It will be noted in the results of the following tests and starting from the measured rise of temperature, that the expansion according to figures is only 70 to 80 per cent of that measured directly on the piece of work by the micrometer. This is due to the fact that the thermometer placed on the tire is unable to keep pace with the relatively rapid rise of temperature and will thus show a lower temperature than the real one.

The Oerlikon Works has made a large number of tests upon wheel tires, and furnishes some of the accompanying test results.

TABLE II—TESTS ON HEATING CAR WHEEL TIRES UNDER SAME CONDITIONS AS IN TABLE I

DIAMETER, COLD, 908.85 MM., HOT, 910.40 MM.
INCREASE 1.55 MM. IN 20 MIN. WEIGHT 250 KG.

Time	Amperes	Watts	Temperature
3.00	129	12,850	17 Deg. C. (air)
3.05	124	17,850	47 Deg.
3.10	119	17,600	76 Deg.
3.15	116.5	17,500	105 Deg.
3.20	116.0	17,250	133 Deg.

The apparatus is designed for single-phase a.c. current at 500 volts and a frequency of 40 to 50. Two sizes are made. With the small size, tires up to 4 ft., 1 in. in diameter can be heated, while the large size will heat tires up to 6 ft., 6 in. in diameter. In principle, there is nothing to prevent making the apparatus of sufficient size to heat the largest tires used.

Jet Propulsion for Airplanes

Jet propulsion for water craft has a very subtle attraction for inventors. It is a sort of will-o-the-wisp to lure them to spend good time and money. The airplane gave another opportunity for the same kind of experimentation although this has, fortunately been rather limited.

The National Advisory Committee for Aeronautics has just issued Report No. 159 dealing with this subject, the author being Edgar Buckingham of the Bureau of Standards. This report takes up matters in a very thorough manner, giving both the mathematics involved and the way in which the jet works out in actual tests. It points out that "in the usual method of driving airplanes, air entering the propeller circle from ahead is projected backward in a continuous stream or race, and the reaction of the race against the air screw constitutes the forward driving thrust. This may evidently be regarded as propulsion by means of a jet; but the term "jet propulsion," as commonly understood, implies the use of a smaller and more intense jet, maintained by some other means than an air screw."

The report sums up the test in these significant words: "The relative fuel consumption and weight of machinery for the jet decreases as the flying speed increases; but at 250 miles per hour, the jet would still take about four times as much fuel per thrust horsepower as the air screw, or propeller, and the power plant would be heavier and much more complicated." This leaves little more to be said and should help to steer inventors into other channels.

Testing Metals with a Microphone

Stretching a metal until it squeaks and listening for the squeak with a microphone will give a test showing how much strain that metal can stand as a girder in a bridge or as a rail in a railroad track, according to experiments conducted in the physics department of Lehigh University.

These experiments will develop a novel method for finding quickly and accurately the elastic limit of metals, the Lehigh scientists expect. By this method all forgings may be rapidly tested before they are put into use on construction work such as mentioned above.

Several kinds of metals have been used in the Lehigh tests. While professors listened through a sensitive microphone similar to the dictaphone for the faintest sound, the metal was subjected to a gradually increasing pull until it broke.

It was found that squeaking, rasping sounds were produced after the pull had reached a certain definite value, and this value was different for the different metals used. The tests indicated that the sounds were not produced until the elastic limit of the material had been reached. The work will be continued with more refined apparatus in the Lehigh physics laboratory, it is expected, so that more accurate tests and data, concerning the strains that different metals may withstand, can be obtained for practical use.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Regrinding, Reboring or Reaming Cylinders—Discussion

BY L. A. HASTINGS
The Heald Machine Co., Worcester, Mass.

The article on page 744, Vol. 58, of the *American Machinist* by M. I. Seiler under the above title shows very clearly that old ideas cling with remarkable tenacity, for while many held similar notions in the years gone by, present-day mechanics know that they were erroneous. We are, therefore, glad of the opportunity to present a few facts brought out by recent laboratory tests. We quote as follows:

"The first examination of the sample submitted was made with a binocular microscope using the highest magnification possible. This examination did not show the presence of any vitreous grain imbedded in the metal. Frequently small pits were found, but they contained no abrasive and are undoubtedly small blow holes in the metal.

"One-half of the sample was then dissolved in a 1 to 1 hot hydrochloric, plus a 5 per cent sulphuric acid mixture. The solution was then filtered and the residue washed with hot dilute-hydrochloric acid until the filtrate came colorless, after which the residue was dried and examined microscopically for the presence of silicon carbide. No trace of this product could be found.

TESTS SHOW NO ABRASIVE IN WALLS

"The other half of the sample was polished on a small felt wheel coated with crocus in order to remove the fiber scratches. The surface was then examined in reflected light with a metallographic microscope. No particles resembling abrasive were found. A portion of the polished surface was then etched with a 5 per cent nitrate acid solution and again examined. Nothing was found which would indicate abrasive particles.

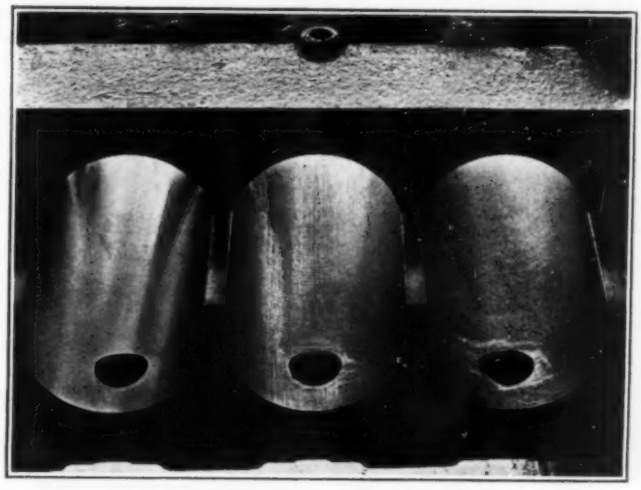
"We are therefore led to the conclusion that, at least as far as the sample submitted is concerned, there was no abrasive imbedded in the surface of the metal."

The remarks about requiring an experienced man to grind a cylinder straight and round can be answered by the fact that the Heald Machine Co. has recently sold 1,500 machines to 1,200 regrinding shops throughout the country. Probably 90 per cent of the owners of these machines never saw one before. Some of them started them up on their own accord and got perfect cylinders from the beginning. With most of them, a half-day's work from a demonstrator was sufficient to teach the man how to run a grinding machine and to get perfect holes.

As to reaming being much better than grinding, the answer is that every high grade manufacturer of automobiles grinds his cylinders. And taking all the manufacturers of motors, 90 per cent of them grind. Either their engineers are all wrong or else grinding is better than reaming.

One of the most accurate and convincing ways of showing the advantages of grinding, over either boring or reaming of automobile cylinders, is by the grinding machine itself. Take a block which has been finished by boring or reaming and set it up on an angle iron on a cylinder-grinding machine. Carefully line it up, and then let the wheel run in and out with just enough feed to spark. Not only the reamer marks, but high and low surfaces will be distinctly shown. Decidedly bright spots will indicate a hard place in the iron which the reamer jumped over. This test also proves definitely whether the hole is at right angles with the base or not; for if it is not, the wheel will grind on opposite sides at the ends.

Several cylinders of well-known makes that are not ground were put through the above tests with the following results: The unretouched photograph shows three holes of a six-cylinder block, ground in this way and then cut away for observation. The hole at the



HOW GRINDING SHOWS UP DEFECTS

right is the original bored and reamed hole. The middle hole was just touched with the wheel, and the hole at the left was ground. Notice the middle hole showing the high and low surfaces. See how definitely the reamer marks are brought out when the porous-like surface is ground away. This last fact clearly demonstrates that a reamed hole will wear much quicker when being run in than a ground hole.

When the piston and rings are assembled in this hole, they will rest on these minute hills of metal. About half the bearing surface is thus lost, due to the depression of metal between each hill. A full bearing surface is not secured until from 0.002 to 0.005 in. of metal has been worn away by the piston and rings. This causes a very rapid wearing of the cylinder wall until it is worn to solid metal. This extra amount worn off causes a large percentage of gas and oil to leak past the ring.

Take for instance the amount of clearance allowed by the manufacturer between the wall and the piston,

which in this particular case was 0.005 in. In order to wear to a solid bearing, another 0.005 in. was necessary. That will make a total of 0.010 in. clearance between the piston and the walls. After a few thousand miles of use this block will begin to cause trouble.

The space between the wall of the cylinder and rings, which has been definitely determined, soon enlarges so much that there is a noticeable loss of power and leakage of oil. This is one of the reasons why cars in which the cylinders were not originally ground require them to be ground and fitted with new pistons and rings much sooner than is necessary to regrind cylinders that were originally finished by grinding.

Spotting for Drilling

BY GEORGE ALLEN

In drilling small holes where it is not necessary or advisable to use guide bushings it is customary to "spot" the hole in order to provide a starting point for the drill. Often the location of the hole is laid out and the spotting done with a center punch. This method, however, will not do for quantity work and some quicker means must be provided to obtain the desired result. One spotting method, used by several makers of spark plugs, is shown in Fig. 1. Here it is desired to spot the hole in the edge of the spark plug shell for the outer spark point wire. Some of the spotted shells are shown at the left, the tools used being shown at the right. The spotting tools in this case are really piloted prick-

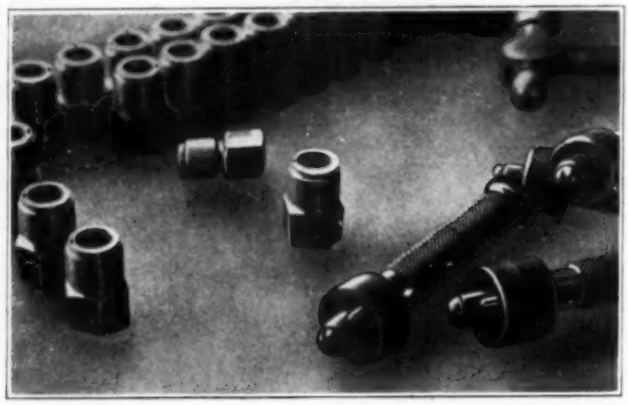
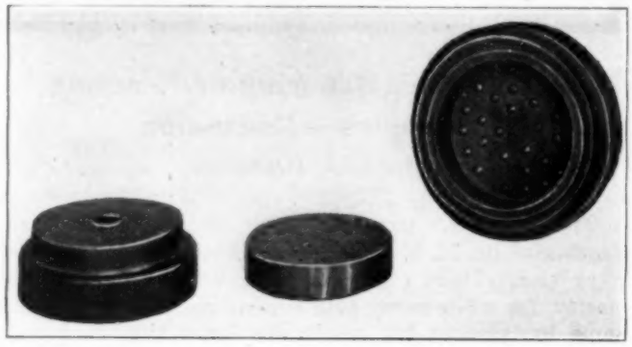


FIG. 1—EXAMPLE OF SINGLE POINT SPOTTING WORK

punches. A shouldered punch body is made with a hardened steel pilot that fits the hole in the spark plug shell. A small pointed, steel prick-punch is set into the shoulder of the punch body in such a way that it will spot a hole in the right place when the pilot is placed in the lower end of the plug body and the tool hit with a hammer. The hole may then readily be drilled on any sensitive drilling machine, after which the spark-point wire can be driven in with a small hammer and staked solidly in place.

The method just described may be used in some cases where several holes are to be spotted at the same time. Where this is necessary all that is needed is the addition of more prick punches, the pilot being made to suit the work in hand. A variation of this idea is shown in Fig. 2, where a number of holes are spotted on a small disk at one operation. In this case the pilot shown at the right is a ring or recess which fits over the disk to be spotted. A spotted disk is shown in the middle and the anvil or base on which the disk is placed, is shown at the left. The guide or pilot ring is made deep enough to both hold the disk and to project slightly down over the upper part of the base. Where so many holes are to be spotted it is not advisable to use a hammer but any small press suitable for light work may be used.

Multiple spotting jigs made on the same general prin-



F.G. 2—MULTIPLE POINT SPOTTING TOOL AND WORK

ciple as this one are in use in some of the clock and watch factories for spotting side plates. The holes in these plates must be accurately located, so the process is to first spot the plates, then drill the holes, and finally hold the plates in special chucks and bore out the drilled holes, one at a time. Much faster work may be done by spotting in this way than by drilling in jigs, as the plates are more quickly handled and the small drills used are not wedged in the bushings or broken by the chips, as is often the case.

An Inside Caliper

BY E. A. THANTON

For simple ingenuity I never saw an inside caliper for rough work the equal of the one illustrated. It is made of two pieces of drill rod, each pointed on one end, and a piece of heavy clock spring. Two holes are cut in the spring, one near each end. These holes are made just large enough to let the two rods slide through when the ends of the spring are held so as to be at about right angles to the rods. By proper fitting, one can hold the ends of the spring so that they will be about parallel to each other when the rods can be slid back and forth. By releasing the ends of the spring the rods are securely locked from movement in either direction. The bow of the spring makes a convenient handle and, when necessary, slight adjustment of the rods may be made by "jarring" as with ordinary inside calipers.

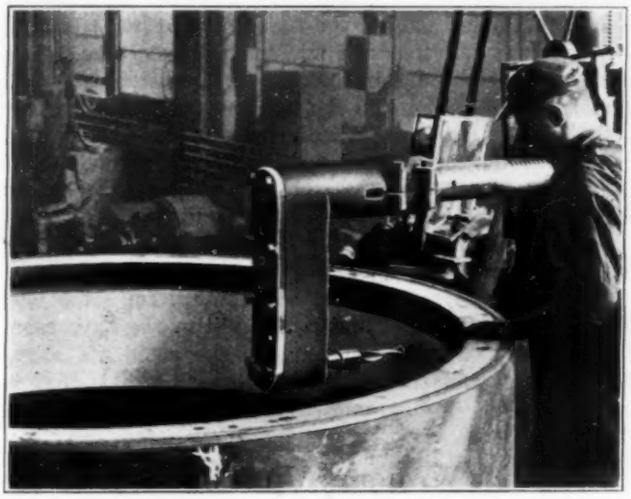
AN INSIDE CALIPER

For large holes, cylinders and the like, it is much easier to adjust calipers of this type than the ordinary kind, as all that is needed is to insert the caliper, loosen the spring with one hand and slide the rods between the fingers of the other hand, until they contact with the wall of the hole. The spring is then released which locks the rods as set.

Using the Offset Drill-Arm

BY A. BECKER

While the offset drill arm shown in the accompanying photograph may be "old stuff" to some of your readers, it will undoubtedly be interesting to many others. The arm is shown in use here drilling and facing a field yoke for a generator at the Allis-Chalmers plant, Milwaukee, Wis. The machine is a Pawling & Harnischfeger No.



USING THE OFFSET DRILL ARM

1 horizontal drilling and boring machine. The yoke is of cast iron, 7 ft. in diameter and is clamped to a turntable so that it can be easily revolved, thus making it accessible from all points. The drill arm carries seven gears, the top one of which is attached to a taper shank that fits into the machine spindle, the bottom one being fitted around the sleeve that receives the drill shank. The arm is held stationary by clamping to the spindle sleeve of the machine as shown.

With this arm the operator drills 16 1⅞-in. and 16 ⅛-in. holes through 5 in. of metal and spot-faces the 32 holes in 5 hr., including the time for set up and removal.

Annealing Locomotive Parts

BY FRANK C. HUDSON

It is customary on some railroads, as well as in other shops, to periodically anneal parts which have been subjected to stresses while in use. Such parts as locomotive side rods and load chains for cranes are among the parts most frequently treated in this way. This annealing is for the purpose of removing what we have called crystallization and restoring the parts to their normal strength. Where suitable annealing furnaces have not been provided, the desire to conform to proper practice has led to such makeshifts as seen in the accompanying illustration. This consists of two walls placed a few feet apart and surmounted by old rails as shown. Across the walls are laid short lengths of old rail, on which the connecting rods and other parts to be annealed are laid. An open fire is built between the two walls, which tends to confine the heat and direct it up to the supporting rails and the parts which they carry.

In discussing this practice with a metallurgist friend, he called attention to the fact that many engineers are

ANNEALING SIDE RODS OUT OF DOORS

now discarding the old theory that crystallization occurs as a result of alternating stresses. If a side rod, for instance, contains internal stresses when put into service (as a result of unequal forging or localized chilling) the gradually increasing load changes occurring when the engine is being "run in" actually increase the elastic limit and make the piece a better part for its intended duty.

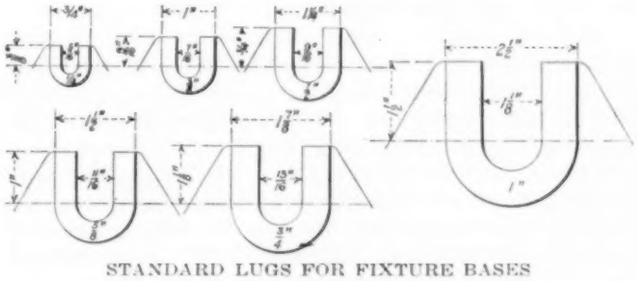
According to the new theory, which seems to be backed by many exhaustive tests, frequently applied alternating stresses such as either the chain or the side rods received in actual use, really increase the strength of the material, as long as it has not been stressed beyond the elastic limit. Subsequent annealing, unless very carefully done, will often do a great deal of damage. Unequal heating will introduce internal strains, and local overheating causes very rapid crystallization.

Knowing that railroad shop officials desire to keep thoroughly up to date and to avoid unnecessary work in the overhauling of locomotives, I am taking the liberty of calling attention to the latest practice of metallurgists concerning the heat treating of steel and particularly as it applies to reciprocating parts.

Standard Sizes for U-Lugs

BY CLARENCE D. SCROM

To the draftsman who is called upon only occasionally to design jigs and fixtures, the dimensioning of lugs for the holding bolts is a problem that involves



STANDARD LUGS FOR FIXTURE BASES

considerable study that should be entirely unnecessary. To relieve him of this extra work and to establish a uniform standard for such parts in our shop, we have made the drawing shown in the accompanying sketch to cover all sizes of bolts from ¼ to 1 inch. The sizes given are wide enough in range for the general run of fixtures used in the average shop.

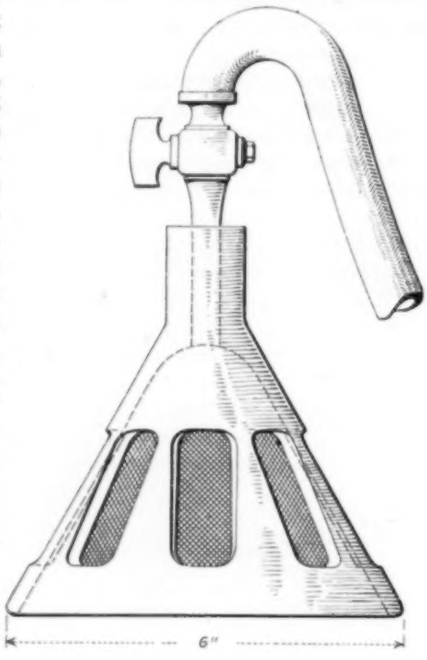
Reducing Eye Accidents in the Shop

By H. R. Fowler

The insurance inspectors had been getting after us about the increasing number of eye accidents, so it was up to us to do something to reduce them—the accidents; not the inspectors.

Of course, goggles were the first thought, but it did not seem reasonable to make every man buy a pair, considering the cost, so we decided that the company should buy 100 pairs to be checked out from the tool crib as needed. That was all right until it was found that a good many of the men objected to using the goggles after they had been on some other fellow's sweaty face, and then, too, it was a nuisance, going to the tool crib to get a pair of goggles just to grind a lathe tool which "wouldn't take but a minute anyhow."

Proceeding on the theory that something a person gets for nothing is not appreciated, we put it up to the men to pay a nominal price (in this case 25 cents) for a pair of goggles that cost the company $1; the goggles to be the sole property of the man using them. I don't know whether or not it was the bargain price that did it, but in a short time there were more goggles being worn than we had ever been able to have used under any other scheme. In fact the inspector, on one of his trips, jokingly accused us of "planting" several men wearing goggles where he would be sure to see them. But in spite of anything we could do, we could not induce the men to put on the goggles every time they went to the grinding wheel, and sometimes we could hardly blame them.



CHIP GUARD ON AIR HOSE

We heard that an automobile accessory house in town had some 9-in. plain round glass headlight lenses which were no longer legal for their intended purpose (outside of Cuba) and which we could get for 10 cents each. We bought as many of the glasses as we had tool grinders, made a frame to hold them and fastened them to the grinder stands in such a way that a man could put his face clear down until his nose touched the glass if he wanted to, while he watched the tool being ground, yet his eyes would be perfectly protected. We found it advisable to make it the duty of some man who worked near each grinder to see that the glass was wiped clean at least once each day, and this removed the last objection anybody had to the guards.

We still found cases of eye trouble arising from chips which were blown out of castings by an air hose; particularly on a drilling machine where the chips had to be blown out of blind holes. We tried holding a rag around the end of the nozzle to baffle the chips. This was all right, but a nuisance to use.

When your wife uses a vacuum cleaner, what becomes of the air that is sucked in along with the dirt? Why, it passes through the mesh of the cloth bag of course, leaving the dirt behind. Going on that principle we made a sheet-iron funnel about 6 in. across the large end, the small end being soldered to the brass nozzle of the air hose.

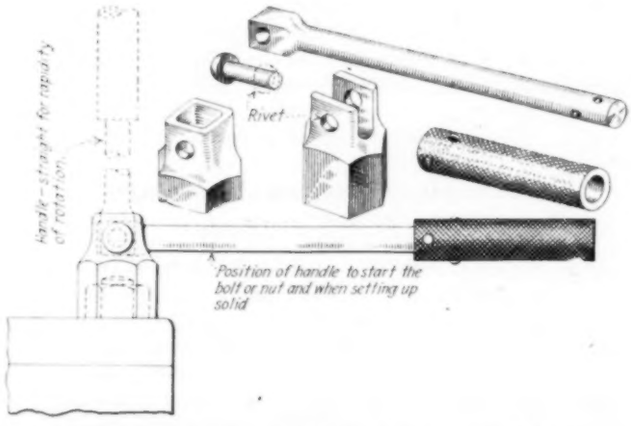
All around the body of the funnel we cut holes 1x2 in., over which was soldered fine-mesh brass wire. The sketch shows the arrangement. In operation, the man would direct the hose on the work in the usual manner and the chips, instead of flying back in his face, would be caught by the funnel, while the fine screen would permit the air to pass through. It worked so well that we made a pattern and got some light brass castings for the funnel, as the sheet iron ones soon got bent out of shape.

While the device is not as satisfactory for some jobs as we would wish, still it beats anything we have seen. Incidentally we have reduced our eye accidents about 70 per cent, and the inspector seems to think that is pretty good.

Wrench With an Adjustable Handle

By G. A. Luers

For special work where a number of similar bolts or nuts are involved, as on cylinder heads of engines, some special form of wrench which will permit of working the nuts loose and then spinning them off, will save in time and effort. The wrench shown in the illustration meets the above requirement. A socket of the type used with a detachable handle is fitted with a hinged handle, which is simply a piece of cold-rolled or other steel,



WRENCH WITH AN ADJUSTABLE HANDLE

secured to the socket after slotting, with a loosely fitted rivet. The section of the handle for the hand is a piece of pipe, riveted on and knurled coarsely. With the handle at right angles to the socket, the leverage is substantial enough to start or tighten any bolt or nut within the capacity of the socket. With the handle in line with the socket, it is possible to rotate the wrench with the hand, unscrewing the bolt or nut with considerable rapidity. As a means of saving minutes of time in overhaul work, such a wrench can be used to advantage in many places.

Piston Clearances in Automobile Engines

BY FRANK C. HUDSON

The question of proper allowance between the piston and the cylinder bore, is always open for discussion. Bearing in mind the various ideas on the subject, I have made inquiries as to what is the best clearance in many shops, ranging from Boston to San Francisco, and from the Gulf of Mexico nearly to the Canadian border.

The general practice may be summed up as being a clearance of 0.001 in. per in. of diameter.

The amount of clearance varies in different shops, the tendency being to make it less for cast-iron pistons, and for aluminum-alloy pistons with split skirts. Solid aluminum-alloy pistons are frequently given a little more than 0.001 in. clearance, per in. of diameter, but this latter amount will do very well as an average.

In some shops, which pride themselves on the best work, pistons are made with as little clearance as 0.0005 in. per in. of diameter where, as they say, "they know who is going to run the car for the first thousand miles." One of the best shops I found uses a clearance of 0.00075 in. per in. of diameter plus 0.001 in. Thus, on a 4-in. cylinder the clearance would be 0.003 + 0.001 in. or a total of 0.004 in., the same in this case as if the regular clearance of 0.001 in. per in. had been used. This method increases the clearance on small sized cylinders and decreases it on larger sizes, but is claimed to work out well in practice.

One shop makes a specialty of Dow-metal pistons and allows a clearance of 0.00075 + 0.002 in. or, in the case of the 4-in. cylinder referred to, a total of 0.005 inch.

All of which goes to show that the clearance of 0.001 in. per in. of diameter isn't far wrong on average automobile engines. This clearance of course refers to the piston skirt, below the lower ring in the piston head. Above that point the piston is frequently tapered, or else the diameter of the land between each ring is made approximately 0.001 in. smaller than the one below it, to take care of the increased heat in the piston head.

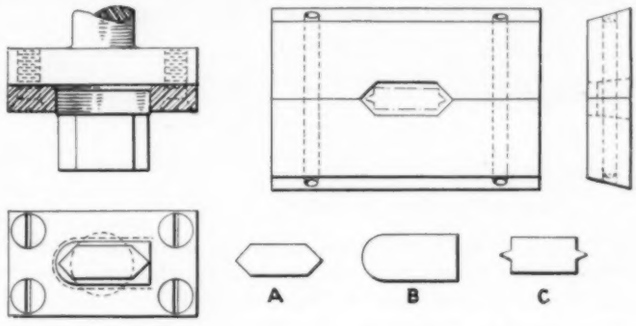
Utilizing Obsolete Dies

BY S. A. MCDONALD

The question of what is to be done with obsolete dies has puzzled most superintendents where many dies are made and used.

It has been the writer's experience that obsolete dies are allowed to accumulate until the storage space becomes so crowded that in desperation a clean sweep is made and they are sold as junk. Perhaps it seems a waste to throw away a die that cost $150, yet it is better than to allow it to take up valuable space. There is, however, another way to handling this problem. The average small die is made to a more or less standard construction and many of the parts can be used over again. If the obsolete dies are stored so that the draftsmen or the foreman of the die department can see at a glance just what there is on hand, they can utilize many of them as the following incident will illustrate.

An order came to the die department for a die to make the piece shown at *A*. The foreman found a punch for making a piece as shown at *B*, and a die to make the piece shown at *C*. By coating the hardened face of the punch with copper solution he was able to scribe off the shape of the sample *A* on it. He then sent the punch to the operator of the surface grinding machine and had him grind to the scribed line. Slow? Yes, but not as slow as annealing, machining and rehardening. The die was laid out in the same way. Being made in two parts it was taken apart and both



HOW OBSOLETE DIE PARTS WERE UTILIZED

parts ground together and then the clearance ground in each half separately. The filling of the stripper to the new shape and then assembling completed the job.

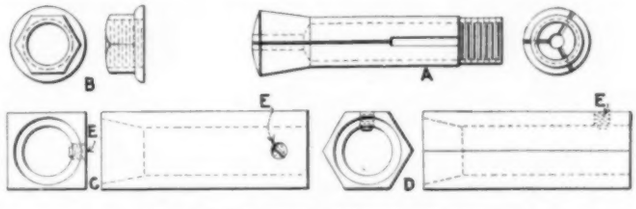
Of course it is not always possible to use as much of the obsolete dies as in the above case, but even if it is only a die shoe or a punch holder, they in themselves represent considerable saving in material, machine work and labor.

Spring Chuck Adapters

BY E. A. SISSON

A time saving device in the small production shop is the spring-chuck adapter illustrated in the accompanying sketch.

Frequently one has a small counterbore to cut, tap to flute, or a punch to mill. Without a device of this kind the workman must necessarily place the dividing



ADAPTERS FOR SPRING CHUCKS

head on the milling machine that he may be enabled to get the proper spacing. This device is used in the vise which comprises a part of the equipment of every milling machine. To get the spacing, simply turn the device by removing from vise and resetting. Sometimes small reamers can be fluted in this manner just as well as if held either on centers or in the jaw chuck on the dividing head. The device is also handy when there are screws to slot.

A regulation spring chuck, which is a part of the equipment furnished with some makes of tool room lathes, is shown at *A*.

B is the draw-in nut, *C* is a square form of adapter, and *D* one of hexagon form. *E* is a screw engaging in a slot in the chuck and used to prevent it from turning. The manner of use needs no explanation.

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Editors

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Encouraging Commercial Aviation

IT IS generally agreed that before aviation can be a real factor in commercial transportation, landing fields and other facilities for cross-country travel must be available. But while this has been generally understood, little has been done except by a few individual companies and by the air mail, with its wonderful record.

The State of Florida now proposes to take a real step in the right direction by appropriating $100,000 as a fund for "the aid of aerial transportation into and within the State of Florida." It is proposed that this sum be used to defray "half the cost and expense of buying suitable locations for, and the erection of suitable hangars and workshops for the housing and care of the flying machines of bona-fide aerial transportation persons, firms or corporations operating within the state." The costs are to be distributed among the towns, cities or counties who shall govern and control the franchising and gratuitous leasing of the hangars. Bona-fide operators must utilize five or more aircraft in the carrying of passengers, mail or express.

This action is in the right direction and it is in such localities, where rail and road transport is lacking, that aircraft can make its best showing in its present stage of development. Florida is to be commended for its progressive attitude and the plan, if it is well carried out, should be of considerable benefit to the state.

Care of Small Tools

THERE are many machine shops where pride is taken in the keeping of small tools in first class condition and where they are stored neatly and accessibly. It is a pleasure to go into the toolroom of such shops and inspect the shelves and drawers of small tools, all properly labeled or marked, all bright and shining and with sharp edges. It is a real pleasure until one begins to look a little closer. Then it becomes evident that there are faults possible in small tools which are not visible to the casual observer.

Here is a drill which looks good until we use it for what it was intended: making holes. Then we discover that only one lip is cutting. Poor grinding. Here is another one; we can file one lip without any trouble. It had been burned and not enough metal was ground away. Here is a broad nosed planer finishing tool. The edge is not straight: it will make a series of grooves instead of a plane surface and the finish that it leaves will require an excessive amount of scraping. There is a milling cutter with burrs in the inner edge of the teeth; ground in the wrong direction. There is another one, hard all over except at the cutting edge; too vigorous grinding and probably toward the edge instead of away from it. Here is a chucking reamer of correct diameter and beautifully finish ground, but the corners of the teeth are not rounded. Be careful with this tool, run slow and with moderate feed or else the chips will stick to the corners and scratch the work. The rounded corners would have allowed greater speed, more feed, longer life and would have avoided spoiled work.

Keeping small tools in order is a two-sided affair. To keep track of them, to mark and label them, to oil them and store them properly and give them to somebody to sharpen, when they are returned from the factory, is one side; a very important side, it is true, but, after all, only one side. The other side is to keep them so that they will do the maximum of the best kind of work with a minimum of tool cost and loss. The first requires a man of orderly habits and a clerical turn of mind, the second requires a mechanic, who knows how and why.

Are You Making Use of Department of Commerce Facilities?

ARE YOU, as an American business man, making full use of the facilities for extending your business offered by your Department of Commerce? Appropriations granted the Department by Congress have been increased considerably since the war and while they are not adequate by any means, they are at least sufficient to insure very much improved service to American business men.

One phase of this service is represented in the publications *Commerce Reports* and the monthly *Survey of Current Business*. If you have any foreign business or ever expect to have any, you can hardly afford to miss the latest reports of the consular representatives and commercial attaches on conditions in the countries where they are stationed. Not only is the information news, and accurate news, at that, but it is presented in an easily readable fashion. The present form of *Commerce Reports* is in sharp contrast with that of the average dry official document. A valuable part of this magazine is the specially selected industrial news, picked from foreign representatives' reports by the chiefs of the commodity divisions, men chosen for their knowledge of their respective fields.

The *Survey of Current Business*, issued each month, reviews developments in various United States industries that have occurred since the publication of the previous issue and gathers in one pamphlet reliable statistics from all sources. Most business men nowadays pay careful attention to statistics in laying their plans for the future. For them, the *Survey of Current Business* is a valuable reference.

The cost of Department of Commerce publications is merely nominal and not at all in proportion to their value. Why not use them?

Shop Equipment News

J. N. Lapointe Hydraulic Broaching Machine

The J. N. Lapointe Co., New London, Conn., has just placed on the market a broaching machine that is a noteworthy departure from previous types in that the large screw and revolving nut that have usually been depended upon to pull the broach have been replaced by a hydraulic cylinder and piston, operated by oil pressure derived from a motor- or belt-driven pump which is incorporated as a unit in the machine.

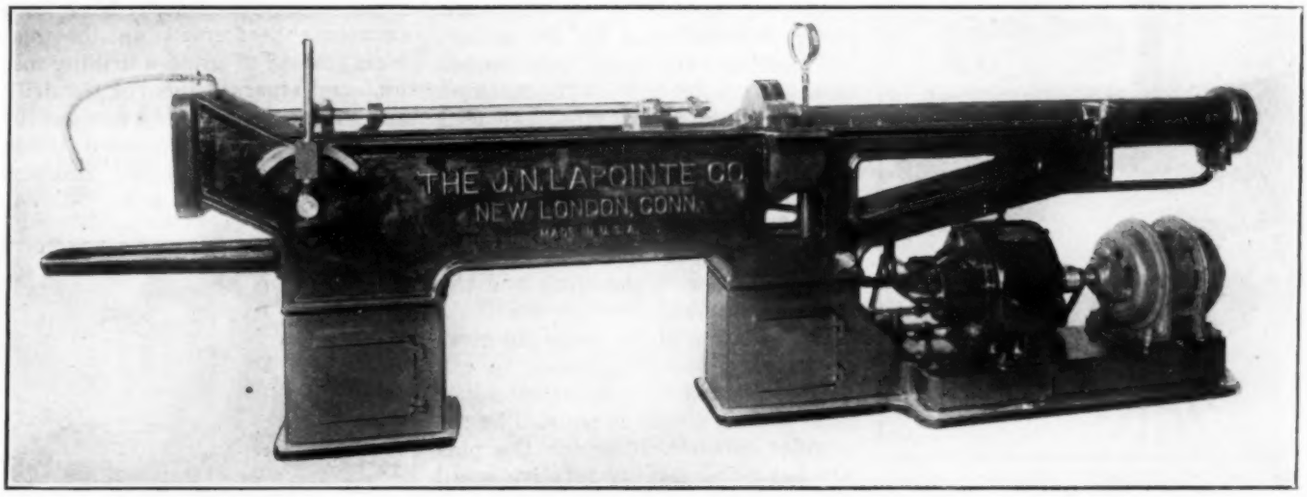
The pump and driving motor are mounted upon an extension to the right pedestal of the machine, the hollow base of which, directly under the pump, is the reservoir for free oil, so that any small leakage that may be due to wear of the packing around the rotor shaft or to other causes will drain back within the pump casing to the reservoir.

A separate pump supplies oil or cutting compound to the broach, and the reservoir or settling tank for this system is in the left pedestal of the machine, where it is readily accessible for cleaning. A cast-iron trough under the broach catches the compound as it flows over the latter and drains it back into the tank. This trough is supported by a single hinge and may be swung back out of the way when mounting a heavy piece of work in the fixture. A pressure of the operator's knee is all that is necessary to displace it, and it returns by gravity when released.

The pressure pump runs continuously at a constant speed, and requires a maximum of 7½ hp. to drive it. It may be driven by belt instead of the motor, if desired. Variable cutting speeds of the pull-rod are obtained by means of the valves and valve shifting levers. A feature of the valve movement is that it may be set to provide a constant speed of pull at any rate below the maximum, and locked with a padlock against accidental or intentional readjustment. When thus locked by the foreman, the operator of the machine cannot increase the cutting speed to the detriment of the broaches.

The maximum pull obtainable at the pull-rod is 35,000 lb. When small or delicate broaches are being used there is a device, also provided with means for locking against tampering, that determines the amount of stress that can be imposed upon the pull-rod. This regulating device can be set and locked for any amount of pull below the maximum and if, by reason of dull broaches or a single hard piece of work, this amount of pull is exceeded, the machine simply throws out of action and remains idle until the cause of the trouble is removed.

The amount of stress upon the pull-rod is, of course, a direct resultant of the unit pressure on the oil, and the direct reading gage upon the cylinder thus keeps the operator constantly informed as to the condition of his broaches. As the latter become dulled by service, a corresponding rise in pressure as shown by the gage indicates the fact, and the broach may be removed for resharpening before a condition is reached that would render it liable to breakage. This feature, together with the regulating devices, safeguards both the machine and the work.



J. N. LAPOINTE HYDRAULIC BROACHING MACHINE

The maximum rate of pull is 25 ft. per minute, with a return at the same rate. The rate of pull may be adjusted from maximum down to zero with the return movement remaining constant, or the latter may be varied to correspond to the rate of pull if desired. The length of stroke is 56 inches. The hole in the faceplate is 5 in. in diameter. The drawhead at the end of the pull-rod has a vertical adjustment of 1½ in. above and below the center line. The floor space occupied by the machine is 13 ft. 6 in. by 2 ft. 3 in., and the weight is 3,500 pounds.

Fraser Vertical Lapping Machine

A machine for lapping piston pins, bearing rollers and similar round work that requires a high degree of accuracy and smoothness of finish has just been placed on the market by the Bethel-Player Co., Westboro, Mass. The principle involved is that of holding the parts to be lapped between the surfaces of a stationary and a revolving lap, meanwhile causing them to be given an irregular motion that sweeps them over the

FRASER VERTICAL LAPPING MACHINE

entire surface of both laps, thus distributing the wear evenly and preserving the truth of the lapping surfaces over long periods.

In the machine shown in the illustration the upper member is stationary, except for the vertical movement that may be applied for the purpose of adjustment or to lift it out of the way for unloading and reloading. This member is an annular lap, made of smooth, fine-grained cast iron, and is attached to the vertical spindle by a floating connection that allows it to adjust itself to any irregularity that may exist in the work at the commencement of the lapping operation.

The lower lap, of the same construction and material, is rigidly fastened to the upper end of the hollow vertical spindle and is given a uniform rotative movement in one direction by a bronze wormwheel and steel worm running in a bath of oil contained in the pedestal. Within the hollow spindle there is a second spindle that is driven through differential gearing, contained in the same case with the wormwheel, at a rate of speed considerably slower than that of the lapping spindle. At the upper end of the inner spindle there is a pin which protrudes above the upper surface of the lap, and which can be adjusted to any desired degree of eccentricity within its range.

The work, if it be such as hollow piston pins, is loaded on a spider having fingers somewhat smaller in diameter than the holes through the pins, each finger being provided with a hardened collar having a bayonet locking device to prevent the work from coming off the fingers while in process. If the work consists of rollers or other solid pieces, a steel plate having cut-out spaces of a size and shape to correspond to the work pieces is substituted for the spider.

The work carrier—already loaded as shown at the base of the machine if the work be hollow pins; unloaded if the work is solid rollers—is laid on the lower lap with the eccentric pin before mentioned engaging the small hole in the center of the carrier. The upper lap is then lowered into contact with the work and the machine started.

The rotation of the lower lap gives the work pieces a tendency to roll between it and the stationary upper lap. This tendency is resisted by the angular position in which the pins are held, the varying rotative speed that would be imparted to the work by reason of its being in contact with the revolving lap at various radii, and by the gyratory movement imparted to the work carrier by the slow rotation of the eccentric pin on the inner shaft.

The opposing forces thus applied give the work pieces a combined rolling and sliding movement which, during a period corresponding to 200 or 300 revolutions of the lap, causes the work to cover the entire surface of the lap without having occupied exactly the same place twice.

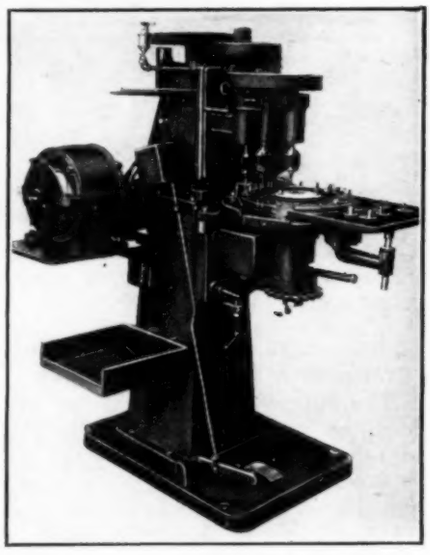
A permanent stationary basin surrounds the lower lap and extends somewhat above its surface so that any lapping compound thrown off by the lap or work is caught and conducted to the bottom of the basin, from whence it may be drawn off by means of a suitable connection.

The machine is belt driven, and a speed of 60 r.p.m. is recommended by the makers. It has a capacity for work pieces up to 1½ in. in diameter by 4 in. long, the number that can be handled at one loading depending somewhat upon the diameter. By using a number of work carriers the time of changing work may be reduced to a minimum. With special conical laps, tapered pins and rollers may be lapped as well as parallel ones.

The machine occupies a floor space of 2½ x 5 ft. and stands 5 ft. high. Its weight is about 2,000 pounds.

Anderson Tapping Machine Arranged for Drilling

The Anderson Die Machine Co., 544 Iranistan Ave., Bridgeport, Conn., has developed an attachment for converting its multi-spindle, continuous, dial-feed tapping machine into a drilling machine, so that nuts or small parts that require to be drilled and tapped may have both operations performed on the machine, instead of using a drilling machine and separate jigs for the drilling. The machine shown in the illustration is the standard three-spindle automatic tapping machine such as described on page 155, Vol.



ANDERSON TAPPING MACHINE ARRANGED FOR DRILLING

56 of the *American Machinist*, but with the new attachment in place.

The reversing movement of the spindles when the machine is used for tapping is obtained by means of a gear segment that meshes with the small pinion to be seen at the top of the machine, which segment is moved back and forth by a Whitworth crank and lever movement. As now constructed, the segment, crank and lever may be removed as a unit by

withdrawing four bolts that attach it to the hub, and by substituting the large spur gear to be seen in the illustration the spindles are given a continuous and uniform rotative movement in one direction only.

The up and down movement of the heads, which is actuated by a cam within the column, remains the same as when the machine is used for tapping. As this latter movement is continuous and automatic, it sets an arbitrary limit of about ¼ in. on the thickness of work that can be drilled; but as the machine was primarily designed for tapping small nuts and sheet-metal parts that are ordinarily well within this limit, the range of the machine is in no way reduced.

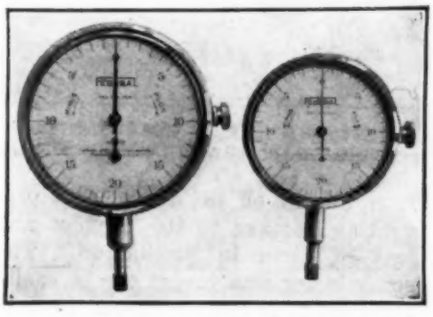
The starting switch has been connected to the treadle so that the machine runs only when the operator stands in his usual position. He cannot, therefore, leave the machine, either by thoughtlessness or design, without stopping it.

Federal Dial Indicators, Models D and D-D

The Federal Products Corp., 15 Elbow St., Providence, R. I., has added the Models D and D-D, here shown, to its line of dial indicators. The features of the new models are the large sized dials and the increased amplification of movement, showing but 0.020 instead of 0.050 in. variation plus or minus from zero.

As in the previous styles of the same instrument, the dial may be set to give a zero reading for any position of the pointer, by turning the knurled bezel ring, and the latter may be locked against accidental disturbance by means of the clamping screw.

The cases of the instruments are machined brass castings and the mechanism is the standard Federal rack and pinion movement. The diameter of the dial of the Model D instrument is 2⅛ in. and of the Model D-D, shown on the left, 2¾ inches.



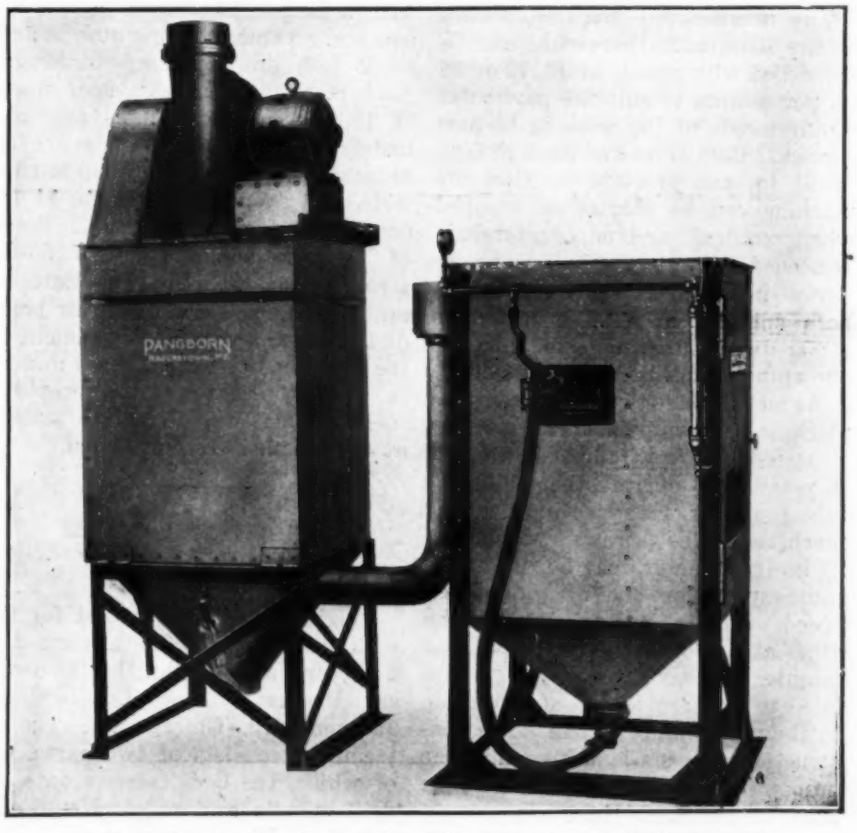
FEDERAL DIAL INDICATORS, MODELS D AND D-D

Pangborn Complete Barrel-Type Sandblasting Unit

For cleaning small work and a small volume of parts such as produced in moderate sized plants, the Pangborn Corp., Hagerstown, Md., has recently placed on the market the complete barrel-type sandblasting unit shown in the accompanying illustration. The unit has an exhauster, dust arrester and motor drives for the barrel and exhauster.

The suppression and accumulation of dust and satisfactory ventilation, which are essential whether handling gray or malleable iron, steel or brass castings, forgings or stamped pieces, has been accomplished by means of the cloth-screen dust arrester. The parts are shipped fully assembled and ready for operation by connecting with a ventilating pipe and compressed air.

A single nozzle having a small air requirement is used in the drum. Two sizes of drums are available for the outfit. The No. 1 barrel has a drum 20 in. in diameter and 16 in. long, and together with the dust arrester occupies a floor space of 3 ft. 3 in. x 7 ft. A drum 30x20 in. is provided for the No. 2 barrel, which occupies an overall floor space of 3 ft. 7½ in. x 7 ft. 5½ in. The overall height of each is 8 ft. 10 inches.



PANGBORN COMPLETE BARREL-TYPE SANDBLASTING UNIT

M & S Grinding Wheel Dresser

The M & S Manufacturing Co., P.O. Box 294, Hartford, Conn., is putting on the market the grinding wheel dresser shown in the accompanying illustration. Though the principle of this dresser is by no means new, the makers have simplified its construction and developed a neat and serviceable tool. It is

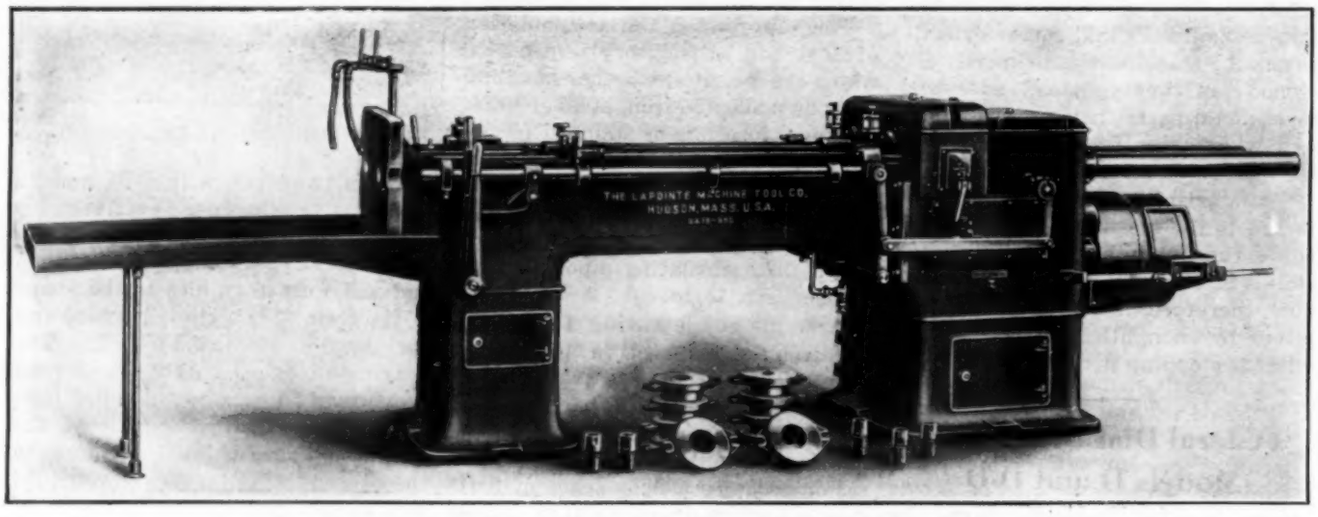
M & S GRINDING WHEEL DRESSER

made in two sizes, with 1 in. and 2½ in. abrasive wheels, respectively.

The handle is made from a single piece of steel tubing, split at one end and formed in dies to the shape of the fork. The grip is knurled and the handle is nickel-plated. The bearings upon which the wheel runs are furnished by a round-ended stud set permanently in one side of the fork and a ball-pointed setscrew in the other, the latter being provided with a lock-nut for the purpose of adjustment. The wheel center is a pack-hardened steel bushing with deep conical centers, running upon the ball points held in the fork.

Lapointe Improved No. 3 Duplex Broaching Machine

The Lapointe No. 3 two-speed duplex broaching machine for the rapid production of duplicate parts, which was described on page 746, Vol. 52, of the *American Machinist*, has been improved so that the number of working parts has been reduced, thereby increasing the simplicity. A positive driving hardened steel clutches, having an eight point contact, while the return strokes of the heads operate by means of friction clutches which give a quick return at four times the cutting speed. Large roller bearings are employed to take up the end thrusts of the



LAPOINTE IMPROVED NO. 3 DUPLEX BROACHING MACHINE

single-speed machine is also now available, as well as the two-speed machine formerly made.

The single-speed machine, shown in the illustration herewith, can be furnished with speeds of 48, 72 or 96 in. per minute to suit the particular requirements of the work to be performed. Both tight and loose pulleys 18x6¼ in. are provided so that the machine can be started or stopped when required, and no countershaft is needed. The two spindles are entirely independent of each other; both spindles may be operated in either direction at the same time, or one spindle may be operated alone.

As on the older type, the two-speed machine has two pull screws that are independently controlled, so that it is possible to operate them alternately, together or as two independent machines. The screws, which are 2¾ in. in diameter, may be run at the same speed, or one at the higher speed of 72 in. per minute and the other at the lower speed of 48 in. per minute. Either screw can be regulated to take any length of broach up to the maximum of 50 in. The construction allows a long broach stroke on one screw and a short one on the other at the same time.

Both machines are equipped with nuts, and the mechanism is entirely enclosed, running in a bath of oil.

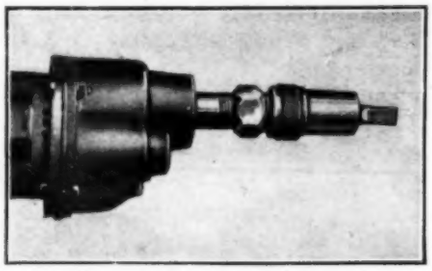
The machines are each furnished with a Brown Sharpe oil pump, oil pan and strainers, screw guards and stock pull and reducing bushings. Each machine occupies a floor space of 180x40 in. and weighs approximately 5,000 lb. The capacities are for broaching in steel keyways up to 1 in. wide, and square holes up to 3¼ in. across flats from drilled holes. Some of the specifications are a 50-in. stroke, 5-in. hole in faceplate, a center distance between screw holes of 13 in. and a vertical adjustment of the drawhead of 1⅞ in. below and 1¾ in. above the center of the faceplate. A 10-hp. motor to drive the pulleys at 450 r.p.m. is recommended.

Thor Screwdriver Attachment

A screwdriver attachment for use with the Thor portable electric drill has been developed by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The attachment consists of two parts, one of which, the body, screws onto the drill spindle and revolves with the spindle. The second part is the shank that carries the screwdriver by means of a knurled sleeve, as shown in the accompanying illustration.

The contacting ends of the parts are milled out to form a dog clutch, and as the sleeve is loose on the body the clutch can be engaged or disengaged at will, making it possible to hold the screwdriver stationary while the drill is running. When not held by the hand, the clutch is disengaged by a coil spring in the back end of the blade and that is attached to the body body. When screws are drawn up tightly, the clutch automatically releases. The screwdriver bits are located in a square hole, and are held in by means of a spring which is out of the way when not in use. The spring can easily be pulled out to release the bit for changing.

The attachment is also made with a bell-shaped self-centering finder, to assist the operator in locating the slot in the screw head. The finder will also prevent the screwdriver



SCREWDRIVER ATTACHMENT ON THOR PORTABLE ELECTRIC DRILL

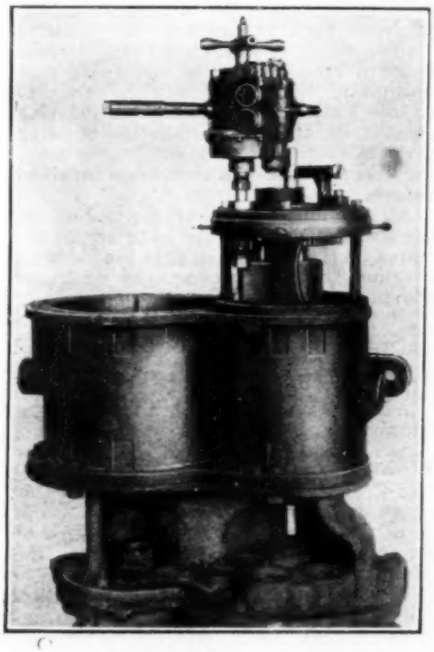
from sliding off the screw, thus preventing damage to the product and loss of time in production. The screwdriver attachment can be easily attached to or removed from the drill driving it.

Underwood Portable Boring Bar Equipment

A recent development in the line of portable boring bars manufactured by H. B. Underwood & Co., Philadelphia, Pa., is the improved equipment shown in the illustration herewith. The machine is particularly adapted for reboring pump cylinders and air compressor cylinders on locomotives, in railroad equipment shops and industrial plants. Because of its light weight and compactness the equipment may be used in close quarters, so that air compressors may be rebored while in position on the locomotives.

This self-contained boring tool consists of a cutter head and a bearing plate carrying a boring bar, driving spindle and feed screw mounted on a clamping ring. A Morse taper shank is attached to the driving spindle to fit the air motor. The spindle drives a pinion which meshes with a gear keyed to the boring bar.

A feed gear, which is keyed to the



UNDERWOOD PORTABLE BORING BAR EQUIPMENT

feed screw, meshes with a reverse gear that runs on a pin centered on the boring bar. The reverse gear turns freely on this pin unless it is prevented from so doing by the engagement of a feed pawl. This pawl serves to hold the reverse gear stationary relative to the bar, and causes the feed gear to revolve the feed screw and to advance the cutterhead into the work. To return the cutterhead to the top of the cylinder, the air motor is placed on the shank of the reverse gear, which thus rapidly returns the cutterhead.

When the equipment is to be applied to the work the pilot guide is screwed to the stuffing box and the bar is placed in the cylinder. Then the clamping ring is fastened to the top flange of cylinder by studs and nuts. Any inaccuracy in the position of the studs in the cylinder flange is overcome by means of four thumbscrews, which may be manipulated to set the bar in alignment. The tool is adjusted and held in the cutterhead by tightening the collar screw, which operates the tool clamp. The tool may be released when the cutterhead is at the lower end of the cylinder.

In boring cylinders to a certain diameter, the use of calipers is dispensed with, since each bar is furnished with a gage that provides a method of setting the tool to the required position. In this manner a number of cylinders can be bored to accurate dimensions with a minimum of lost time in resetting the tool after regrinding.

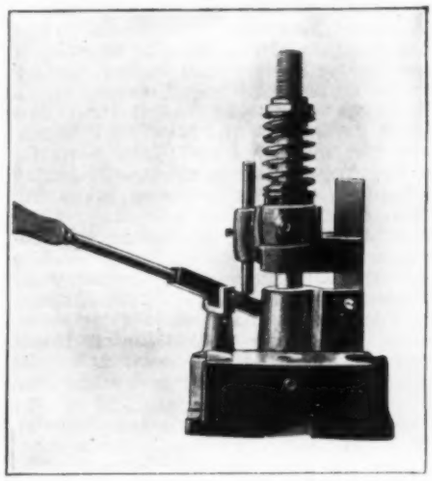
The boring tool is regularly made in sizes suitable for reboring cylinders and bushings of standard compressors, but it may be readily adapted to other sizes by a change of cutterheads. The weight of the equipment with a capacity to bore from 8¼ to 11 in. in diameter by 12 in. stroke, without the air motor, is approximately 140 lb. For compound compressors 8¼ x 14¼ in. in diameter by 9 x 14½ x 12 in. stroke, the outfit weighs about 200 pounds.

Selfclamp Universal Drill Jig

A single-pillar self-clamping drill jig has been added to the line of universal self-clamping jigs now being marketed by George A. Gloor, 646 Catherine St., Detroit, Mich. The base and top plate of the jig are of cast iron, all other parts being of steel.

Locating fixtures for any kind of work can be attached to the base of the jig, and bushings for any size hole can easily be attached to the top plate. The bushing slips into the hole in the top plate, and a locating collar screws onto the lower end of the bushing. A taper hole in the collar makes it possible to locate the work instantly.

The top plate slides on a vertical shaft and is held down against the work by means of a spring, as shown in the illustration herewith. A slot in the side of the top plate engages a steel guide, which insures the proper location of the bushing. A vertical rod in the side of the top plate is so located that the lower end rests on the inner end of a hand lever pivoted a short distance from the end. Thus bearing down on the handle end of the lever raises the rod and top plate so that the work can be located in



SELFCLAMP UNIVERSAL DRILL JIG

the jig. When the lever is released, the spring forces the top plate down onto the work and holds it in position for drilling.

The jig is adaptable for a large variety of work by changing the bushing and adapter. Since these portions can be easily changed, the jig can be kept in use almost continuously. If parts become obsolete, only new adapters are required to fit the jig to the new parts.

Kenosha Standard Jig Bushings and Liners

The Kenosha Die & Stamping Works, Kenosha, Wis., has developed a line of standard jig liners and shoulder bushings for use in jig and die construction. The sizes of the bushings correspond to standard drill, tap drill and reamer sizes, although special sizes will be furnished upon application.

The standard sizes of the liners range from ⅛ in. hole diameter x ⅛ in. outside diameter x ⅜ in. long to 3x3⅜x4 in.; and the standard bushings range in size from ⅛x⅛x⅜ in. to 2⅜x3¼x5⅛ in. All holes under ⅛ in. in diameter are lapped to a slip fit and sufficient stock is left on the outside to allow for a press fit. All bushings are made of high-grade tool steel, carefully hardened and ground.

News Section

Inspection Trips and Interesting Papers Are Enjoyed by Taylor Society

INTERESTING papers and educational inspection trips characterized the exceptionally successful meeting of the Taylor Society held June 7, 8 and 9 at the Onondaga Hotel, Syracuse, N. Y., in co-operation with the Central New York section and the New York Southern Tier section of the Taylor Society.

The first session opened on Thursday afternoon with H. S. Person, managing director of the Society, presiding. Willford I. King, of the Bureau of Economic Research, New York, read a paper on "Safeguarding Industry by Stabilizing Employment." An abstract of this paper will appear in a forthcomissue of the *American Machinist*. It was followed by a discussion led by the chairman and indulged in by Carleton F. Brown, general manager of the Corona Typewriter Co., Inc., Groton, N. Y., and Dr. N. I. Stone, general manager of the Hickey-Freeman Co., Rochester, N. Y., who both expressed interesting views.

On Thursday evening the second session was held. Edwin W. Kendall, general sales manager, Pass & Seymour, Inc., Syracuse, presided and Harry R. Wellman, consultant on sales problems and vice-president in charge of selling at the Walter M. Lowney Co., Boston, Mass. delivered a paper on "The Sales Machine; 1923 Model."

Value of Co-operation

Mr. Wellman told of the evolution of salesmanship from the time of the peddlar up through the chain stores, self service devices and back again to the new "store at your door" idea which is peddling on a large and improved scale. He stated that the ideal condition for the manufacturer was to have his sales department, his production department and his finance department working closely together.

On Friday morning there was an inspection trip to the planning department of the Corona Typewriter Co. at Groton, the trip being made by automobile to Cortland and Groton. The party left Syracuse at eight o'clock arriving at the Cortland plant at nine-thirty and at the Groton plant at eleven o'clock. At noon a luncheon was served at the Corona gymnasium and a concert enjoyed which was given by the Corona band of thirty-five pieces. At half past four the party started on the return trip to Syracuse.

Friday evening, S. H. Cook, vice-president of Brown-Lipe-Chapin Co., Syracuse, presided and Keppele Hall, superintendent of the planning for the Joseph & Feiss Co., Cleveland, Ohio, delivered a paper on "The Planning Department as an Instrument of Executive Control."

Mr. Hall characterized the planning department as that department that is doing certain little things for other departments and thereby keeping down the cost of production by the elimination of time, waste and energy. The difference between "variables" and "fixed" expenditures was taken up by the speaker and a most inclusive study of the cost records was explained.

Following Mr. Hall's paper a discussion led by Robert Anderson, production manager of the Bowen Products Corp., Auburn, N. Y., was enjoyed. H. K. Hathaway, consulting engineer of Philadelphia, and Howard G. Benedict of the A. J. Deer Co., Hornell, N. Y., participated in the discussion.

Saturday morning was devoted to an inspection trip to the H. H. Franklin Motor Car Co. in Syracuse where management on the Taylor principals was observed to be most successful.

Ad Men Visit Plant of McGraw-Hill

Several hundred delegates to the Advertising convention just closed at Atlantic City were guests on June 8 of the McGraw-Hill Co. at a luncheon in its building at Tenth Ave and Thirty-sixth St. There was an exhibition of the work done by the trade publications of this country in assisting the Government to dispose of more than $2,000,000,000 worth of surplus machinery bought during the war. A display of industrial advertisements showed different methods of preparing copy and the comparative results obtained.

A motion picture depicting Herbert Hoover's ideas on industrial efficiency was shown. Among the advertising men who attended were: Keith J. Evans, president of the Industrial Advertising Association; Bernard Chapple, Philip C. Gunnion, A. K. Birch, J. C. McQuiston and W. A. Wolff.

Predict Big Auto Year In South Africa

With large crops in sight, with wool and produce bringing good prices, with the mining industry in a strong position, with local industries securing a fair amount of business and general trade improving, the prospects for South African automotive trade in 1923 are much better than they were in 1922, state *Commerce Reports* published by the Department of Commerce. Such unfavorable factors as low production in the diamond mines, dullness in the coal industry, and the fact that the wheat crop will not be a big one are more than offset by a widespread general improvement.

Car importations during 1923 will be not less than 6,000, and more optimistic observers give 6,500 as not an excessive estimate. This is based on the tendency toward larger orders indicated by the imports of the last quarter of 1922, numbering 1,545 out of the total 4,840 for the year. Sales covered not only the year's total importation but also about 275 cars from stocks in bond—about 5,000 in all—as compared with 3,700 in 1921 and 7,800 in 1920; and the sales were easier and of better quality. The country districts bought more freely, and the credit business was not at the high percentage of the year previous.

Car Shortage Being Cut By Railroads

The railroads of the United States are accomplishing two objectives at the same time, according to a statement made by the Car Service Division of the American Railway Association. This shows that while loadings are mounting steadily and more freight is being moved than ever before at this time of the year, the roads have succeeded in steadily cutting down the car shortage until today the supply of cars is virtually normal. This has been done through concentrated work by all the roads together, in accordance with plans outlined by executives who met recently in New York to prepare for Autumn traffic, which it was then feared would reach a crisis. Railroad men are now optimistic that they will be able to handle Fall requirements with existing equipment, this being possible through greater efficiency in loading and moving freight than has ever been attained before.

All previous records are being broken, the Railway Association's statement declares, in the number of cars loaded with revenue freight as compared with car shortage.

Savage Sharon Plant Goes To Westinghouse

Announcement is made of the recent acquisition of the plant of the Savage Arms Corp. at Sharon, Pa., by the Westinghouse Electric & Manufacturing Co. A large force of workmen is now engaged in remodeling and equipping the plant for the manufacture of transformers. It is expected that the plant will begin operation next fall.

The transformer division of the East Pittsburgh, Pa., works of the Westinghouse Co. will be transferred to Sharon, according to the officials, and 3,000 persons, including a large number of girls and women, will be employed in the new plant when it begins operation. The acquisition of the Sharon plant was necessitated by the increasing business in transformers and the need for extending the facilities of production and manufacture of this type of electrical apparatus.

C. H. Champlain, who has been assistant works manager at the East Pittsburgh works, has been appointed works manager of the Sharon plant and M. L. Fawcett, general foreman of the transformer department, has been made superintendent of the new works. Both officials are now engaged in directing the work of fitting the new plant.

American Machine Tools In Swiss Market

Recent reports from Switzerland furnish conclusive evidence that there will be a good market for the better class of American-made machinery and machine tools within a short time and that in those lines where quality is considered paramount American manufacturers will have no serious competition. At the present time, however, business is not good, but those in touch with the European situation are insistent on the point that in order that the full benefits may be reaped American machinery makers should enter the market now in preparation for the better times that are said to be just ahead.

Much trouble is being experienced by the actual thefts of American patents by German machine tool builders. When an American machine is not protected by foreign patents, unscrupulous Teutons copy to a detail. But even in the face of this unprincipled condition, the American workmanship is such as to keep the product superior to its imitators.

It is next to impossible to sell Swiss manufacturers by merely sending catalogs and descriptions. They much prefer actual demonstrations if possible and when once convinced that the American machine is the best competitors have little or no chance.

At the present time the best sellers are: grinding machines, lathes, vertical milling machines and combination turret lathes. Watch makers and the manufacturers of screw products are busy at this time, but the continuation of this trade is problematical. Swiss railways are being electrified on many divisions which has helped the machine tool business since the first of the year.

Car Loadings Pass the Million Mark

Car loadings on American railroads passed the million mark during the week ended May 26 for the first time this year, according to reports filed by the carriers with the American Railway Association. The total of 1,014,029 cars loaded during that week has been surpassed only twice in the history of the country, the high record having been made on Oct. 14, 1920, with a total of 1,018,539 cars.

Loadings of every class of freight showed an increase over the week before, with the exception of coke. The most marked increase was for coal, the gain for the week having been 10,493 cars. The movement of manufactured goods also showed a substantial increase, while ore loadings were at the highest point for the year to date.

Los Angeles Company Is Medal Recipient

The Southern California Edison Co., Los Angeles, Calif., was presented on June 7 with the gold medal of the Charles A. Coffin Foundation, offered for the first time last year, to the electric public utility company of the United States which made the most notable contribution during the year to the development of electric light and power service. This is the first award of the medal to be made by the Foundation which was created by the General Electric Co. The recipient was selected from eighteen electric light and power companies which submitted their year's records for consideration, and the decision is understood to have been extremely close.

Indianapolis Busy But Cautious

The determination of industry to prevent a too rapid expansion of production apparently is having its effect on the machine tool and machinery trade here. The last two weeks have seen a slight decline in the sales volume in both lines. Most of this decline comes from the automotive and such factories as those making furniture, sash and doors and other wood working plants.

Dealers in woodworking machinery report that in spite of the apparent prosperity of the plants, reports from over the country have not been satisfactory in construction volume and these plants are proceeding with caution. This uncertainty concerning construction is due to high prices, plant officials say. The automotive industry has slowed down and will not revive until later in the summer when the fall demand begins. There has been a very slight increase in the number of inquiries for machinery from coal operators. Most of the mines are working but a small percentage of the time and some are shut down altogether, but the inquiries lead to the belief that many operators are getting ready to put their holdings in first class shape before the fall season opens.

Increased Wages Cause Increased Buying

Production, employment, wages and prices are tending toward a level which will lead to a continuance of prosperity, according to the June economic review of the Labor Bureau.

"The fact that continued expansion has not taken place in the building and other industries similarly situated is wholesome," the review said, "since these industries are already producing at their utmost capacity, and a still larger demand would lead to soaring prices and a real collapse of demand."

Employment, the review added, continued to increase, but at a slower rate. The top of the employment curve has not yet been reached because industries will continue to expand, seasonal checks will be overcome and new wage-earners will drift into industry so long as there is a demand.

During May 287 wage increases were reported, chiefly in industries having a large number of employees. Commenting on recent wage increases, the review states:

"The most hopeful feature in the present situation is the one most deplored by many business writers. This is the present rising trend of wages and the 'labor shortage' caused by restricted immigration. The ordinary business writer is so blinded by the individual employer's spectacles that he thinks of the wage-earner merely as a factor in production costs and forgets that he also makes up one of the most numerous classes of consumers. Wages have arisen enough in proportion to retail prices so that the purchasing power of the industrial wage-earning population is from 15 to 20 per cent higher than in 1920. This means a greatly enlarged market for consumers' goods."

New York Dealers Report Better Business

In several instances machinery dealers and machine tool men in the New York district reported this week that business was better during the month of May than during April and one dealer went so far as to state that May was the best month that had been experienced so far this year. In face of the fact that the first part of the month was admittedly poor from a business standpoint, the reports come as a welcomed relief to a condition that was—to put it mildly—unsettled.

The smaller shops have apparently eased up on buying while the larger places have just commenced, according to one dealer who handles quality lines. Another dealer reported that it was merely a matter of going after the right kind of business at this time of the year. Special designs and heavy machinery were still in demand, he stated, but he found that business in small tools was quiet.

Automobile makers are still good customers and railroads are buying, but only after a great deal of shopping around and the exercising of the greatest caution. The Erie R.R. recently bought some equipment for its shops at Hornell, N. Y. and the Pennsylvania R.R. has been in the market for equipment for the shops at Conway, Pa. Other roads have been inquiring with renewed zest.

Some trouble is being experienced in finding certain types of machinery. An inquiry in the New York market for an 8-ft. radial drilling machine for immediate delivery brought to the attention of dealers that there was not one procurable.

Dealers in used machinery report excellent business in all lines.

It is the consensus of opinion that, except for the usual and expected lull that is experienced in Summer, business will move along in a much better course than for several years past. Optimism as to Fall business and a continuation until June, 1924, is readily expressed by prophetic dealers.

Industrial Preparations For Sesqui-Centennial

The industries of the world will be asked to make suggestions for engineering and mechanical exhibits for the proposed Philadelphia World's Fair in 1926, commemorating the 150th anniversary of the signing of the Declaration of Independence, according to recent announcements.

Under the plans now being formulated by the Sesqui-Centennial Exhibition Association in Philadelphia, engineering will have an important part in the Exposition. This was assured through the selection of John Price Jackson, a Philadelphia engineer, as executive director of the Fair. Mr. Jackson is well known among engineers throughout the United States.

"There will be certain primary functions of an economical nature to be performed in building up the industrial exhibits," Mr. Jackson said. "Powell Evans, a distinguished engineer and manufacturer of Philadelphia, has been asked to develop ideas and practical plans for the industrial exhibits, and draw around him a group of our strongest industrialists and engineers to aid him in planning."

Death Ends Career of C. M. Carr

Clyde Mitchell Carr, formerly president of Joseph T. Ryerson & Son, Inc., and a director in several other steel and iron companies, died on June 5, at his residence, 1130 Lake Shore Drive, Chicago, following several weeks' illness. Mr. Carr retired on account of ill health in February but remained a director of the company. Mr. Carr, who was one of the most active and influential members in the Chicago Plan Commission, was born in Will County,

CLYDE MITCHELL CARR

Illinois, July 7, 1869. He prepared for Princeton University at Lake Forest Academy and also spent two years at Northwestern University.

After leaving college he was connected with the People's Gas Light & Coke Co. and later became a salesman for W. S. Mallory & Co., iron jobbers. He has been connected since 1891 with the Ryerson company.

Mr. Car was a director of the Chicago, Great Western Ry., of the Corn Exchange National Bank, of the Art Institute of Chicago, and of the Chicago Orchestral Association. He was a member of the American Iron & Steel Institute, of the University Cliff Dwellers, Princeton, Saddle & Cycle, Up-town and Wayfarers' Clubs.

He served as president of the Commercial Club in 1912-1913 and from 1912 to 1914 as president of the Owentsia Club.

He is survived by his widow, Mrs. Lillian Van Alstyne Carr, formerly of Evanston.

American Piston Ring In England

While the United Kingdom can not be said to offer a market of wide scope for the sale of American piston rings, it does present certain opportunities that should not be ignored by piston-ring manufacturers in the United States, according to *Commerce Reports* published by the Department of Commerce.

These sales possibilities consist mainly in piston-ring replacements for the comparatively large number of American motor cars in use throughout the country. No considerable volume of business with British motor-car manufacturers has been done, however, or is to be anticipated, as the larger number make their own piston rings, and the rest depend mainly on the half-dozen independent firms who manufacture rings in the United Kingdom. Even the replacement channel is partly closed through the preference of owners of and dealers in one low-priced American car to purchase from the British branch of this company direct, where they can obtain piston rings much more cheaply than through other agencies.

Generally speaking, prices for piston rings imported from the United States do not compare favorably with the local product. For competitive purposes an American ring would have to retail in the British market at about 50 cents. At present American piston rings sell for considerably more than this, owing primarily to the import duty of 33⅓ per cent and thus competition is greatly curtailed.

Business Items

Agreement by preferred and common stockholders on a reorganization plan that will protect the interests of both, is expected to end the receivership of the Defiance Machine Works, Defiance, Ohio, in effect more than a year. A $600,000 bond issue will pay the indebtedness.

Gould & Eberhardt, Newark, N. J., have recently mailed out to the trade attractive souvenirs in the form of writing pads that may be used many times over. The pad is a novelty recently put on the market and erasures are secured by merely lifting a thin tissue, whereupon the writing completely disappears.

At public auction in Cleveland, Ohio May 28, the United States government through A. E. Bernsteen, district attorney purchased the Cleveland Brass & Copper Milling Co. for $350,001. The auction had been held by order of the supreme court in an effort to gain the amount due them for six notes and mortgages. The notes and the mortgage, issued by the government during the war, aggregated $454,188.12 and with interest up to yesterday were $514,588.91. P. J. Mullen, special assistant to the attorney general for the United States, had been in charge of the settlement.

The Surplus Steel Exchange, Inc., has been incorporated with headquarters at 7 Dey St., New York City. It will deal in surplus steel stocks.

The Franklin Machine Co., Providence, R. I., has purchased the George H. Corliss Steam Engine Works which was formerly controlled by the American and British Manufacturing Corp. and in the future will manufacture engines and machinery, and will also furnish gray iron castings, new transmission machinery and special machinery. The Franklin Machine Co. is one of the oldest shops in Rhode Island and in 1916 was placed under a new control of management. In 1918 the company purchased the William A. Harris Steam Engine Co. and has since operated it together with the Corliss Steam Engine Works.

The Niagara Falls Smelting & Refining Corp., Buffalo, recently incorporated with a capital stock of $500,000. F. A. J. Fitzgerald and H. O. Babcock of Niagara Falls, W. R. Hopkins, E. C. Jarvis and A. W. Maddigan of Buffalo are the directors.

The name of the Electric Steel Co., Chicago, was changed to Nugent Steel Castings Co. at a stockholder's meeting held in Chicago, May 28. There is no change of management, ownership, or personnel.

The plant of the Wisconsin Engine Co., Corliss, Wis., has been purchased by the B. F. Sturtevant Co., Hyde Park, Boston, Mass., and will be used as the Midwest headquarters for this company.

The Central Sales Office of the Navy Department, United States Government, announces a sale of rail and rail equipment, bids to be opened June 21 at the Navy Yard, Washington.

The plant of the Fedders Manufacturing Co., Bridgeburg, Ontario, Can., has been purchased by the Horton Steel Co. and will be used as a machine shop.

The plant of the Electric Furnace Co., Salem, Ohio, has been purchased by F. A. Hoiles and R. F. Benzinger of Alliance, Ohio, and will be opened shortly.

Personals

HENRY K. SPENCER has been appointed manager of the Blanchard Machine Co., Cambridge, Mass. Prior to the death of Winslow Blanchard, Mr. Spencer was assistant manager and chief engineer for the company.

MANGUS W. ALEXANDER, managing director of the National Industrial Conference Board sailed for Europe June 9. He will investigate industrial conditions in England, Germany, Austria and other countries and is planning a few weeks of rest in Norway before he returns to New York during the first week in September.

C. F. ROGERS, formerly representing C. E. Johansson, Inc., in the eastern territory has been appointed factory representative for the W. B. Knight Machinery Co. of St. Louis, Mo.

FRANKLIN F. CHANDLER, of Indianapolis, has become associated with the Ross Gear & Tool Co. of Lafayette, Ind., as manager of the sales department.

FRANK EHRHARDT, of the South Bend Lathe Works at South Bend, Ind., has been elected treasurer of the South Bend Advertising Club.

Obituary

WILLIAM J. MCCLAIN, a member of the firm of Egbert & McClain, steel, Buffalo, died recently at his home in that city.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE business man who is not cheered by the facts that came to light last week must indeed be misanthropic. Bank clearings reflect a record trade and railway traffic a record movement of goods. Railroad net earnings for April were at the rate of 6¼ per cent annually on properties tentatively valued by the Interstate Commerce Commission at $19,100,000,000. This is the equivalent of nearly 10 per cent a year on their market valuation of about $13,000,000,000. The mail order and chain store concerns report record sales and most retail merchants are doing an excellent business.

Germany has made another offer to settle the reparations demanded of her. It is not likely to be accepted by France and need not be discussed in detail, but it is generally interpreted to mean that those who control the financial policy of Germany are in a trading humor and anxious to make a bargain if they can. The assured success of the Austrian loan has no doubt influenced their attitude for it is an example of what friendly enemies can do for a defeated foe that is compliant.

The total loan is for about $126,000,000 or its equivalent in foreign monies. It runs for an average of 13 years. Principal and interest are unconditionally guaranteed by the following nations in the proportions named: Great Britain, France and Czecho-Slovakia, 24¾ per cent each; Italy, 20 per cent; Belgium and Sweden, 2 per cent each; Denmark and Holland, 1 per cent each. J. P. Morgan & Co. have underwritten the $25,000,000 that is to be offered in New York next week and a simultaneous offering of the British participation will be made in London. The British share is £14,000,000, of which the English government takes £3,119,000 in satisfaction of previous loans, leaving £10,881,000 to be sold to the public.

The bonds offered in the United States will bear interest at 7 per cent and will be sold at 90. The London offering will be in 6 per cent bonds sold at 80. The return in each case will be about 8 per cent. A heavy oversubscription in both markets is predicted. The balance of the loan, amounting to about $30,000,000, is reserved for Continental Europe, and will probably be brought out in Paris, Amsterdam and Prague in July.

The negotiations leading up to the loan were initiated and carried through by the League of Nations and as an example of international co-operation in finance they are probably without precedent in history.

Other stimulating developments include the sale of $3,000,000 bonds for the Canadian Province of Saskatchewan and $22,000,000 soldiers' bonus bonds for the State of Iowa. A number of less important issues have also been successfully marketed.

In connection with the Saskatchewan loan it was brought out that the United States now has a total investment of not less than $2,500,000,000 in Canada.

The confidence in financial conditions here and abroad which these operations bespeak has been reflected on the Stock Exchange as well as in the commodity markets that are sensitive to the wind of public opinion. Wheat and corn have both recovered much of the previous decline attributed to the passage of the Capper-Tincher bill. Cotton is up again and very strong. A slight increase in the export demand has revealed the utter exhaustion of this year's supply, and the action of the Governor of South Carolina in naming Sunday, June 10, as a day of fasting and prayer for delivery from the boll weevil has again drawn attention to a bull argument on cotton that had been temporarily forgotton.

> "If economic omniscience and disinterestedness were to be found anywhere in the word it might perhaps be wise to invest the man or men possessing these unusual qualifications with the right to control prices, but it will require a good deal of persuasion to induce American merchants and manufacturers to believe that bankers and college professors are supermen to whom the power of life and death over business can be entrusted."

Copper is up to 15 cents on a better demand for export that is correlated to the Austrian loan. Sugar, coffee and rubber are all firmer. The steel industry, in which there had been a slight slackening of activity, is again quickening its pace under the stimulus of railroad buying, and the building trade is about the only quarter in which there has been any slowing down. But there is still work at high wages for all the mechanics that are to be had and it is doubtful whether the curtailment is as general as the contractors would have labor believe.

A few cotton mills in certain localities are also taking an occasional day off, but here also there is reason to suspect that the mill managers are trying to forfend a demand for higher wages. In the woolen industry the mills are running on full time as are the automobile makers, and the shoe factories are about the only establishments from which even a seasonal reduction in output is reported.

With every one employed and distributive trade so good it is not surprising that the stock market has turned and that a bullish view is gradually finding acceptance. The railroad shares in particular are coming into favor and with President Harding urging prompt action upon the consolidations provided for in the Esch-Cummins bill it seems altogether likely that many railroad stocks and bonds will soon commence to reflect the increased value which the properties they represent will develop as constituent parts of some great system.

The weekly statement of the Federal Reserve System shows a further increase of $5,000,000 in the gold on hand and a reserve rato of 75.7 per cent, so that abundant credit for a busily employed nation is assured unless the academic economists and statisticians persuade the Federal Reserve Board that it is its duty to interfere with natural law and attempt to control prices.

That something of this kind is in contemplation may perhaps be inferred from the speeches made at a meeting of the National Monetary Association held in New York last Thursday, when it was again urged that our surplus gold supply should be "ear marked" so that it would not appear in the Federal Reserve ratio, and Professor Commons of the University of Wisconsin read a paper on "The Control of the Price Level Through Changes in the Rate of Discount and Rediscount."

If economic omniscience and disinterestedness were to be found anywhere in the world it might perhaps be wise to invest the man or men possessing these unusual qualifications with the right to control prices, but it will require a good deal of persuasion to induce American merchants and manufacturers to believe that bankers and college professors are supermen to whom the power of life and death over business can be entrusted.

Meantime and as long as this latest proposal to put more government in business is disregarded good times would seem to be indicated until in the natural course of events prosperity makes us thriftless, extravagant and indolent and we are again compelled to learn the "uses of adversity."

This is a lesson which cannot be taught by any Price Control Commission, and to urge otherwise is a counsel of perfection that is both impracticable and unattainable.

Austrian Iron and Steel Output Increases

The Austrian iron and steel statistics for the month of March, 1923, show an increase in production of 34,203 metric tons, or 77 per cent, over those of the preceding month, according to *Commerce Reports* published by the Department of Commerce. In addition, the amount of iron ore mined has increased 19,779 tons, or 23 per cent. These increases are attributed to the effect of the French occupation of the Rhur.

Improvement for May in Chicago Markets

The closing of sales on pending inquiries of the railroads still holds the center of the stage in the anticipation of near future business by machine tool dealers in the Chicago district. Industrial purchases continue to be mainly of single machines. The complete statements of sales during May seem to indicate that the average dealer's sales were about ten per cent over those during April, but considerably less than March sales. The Illinois Central R.R. has ordered a 90-in. driving wheel lathe and a 48-in. car wheel borer. The Santa Fe R.R. is making inquiry for a 1,000-lb. single frame standard type steam hammer and one 3½-in. upsetting and forging machine. The Burlington R.R. is inquiring for a motor-driven horizontal single end punch, size 2, with 12-in. throat, 1¾-in. stroke and capacity of 1-in. hole in 1-in. steel. The Rock Island R.R. is inquiring for one motor-driven 48-in. swivel head turning and boring mill, one motor-driven 16-in. portable engine lathe, one belt-driven 60-ton rod press and one motor-driven 36-in. engine lathe.

Machinists in the Chicago district, both in railroad and contract shops, through the International Association of Machinists, are requesting wage advances which approximate twenty-five per cent. The wages now paid to machinists range from sixty to eighty cents per hour.

Chicago steel producers are optimistic regarding the last half of the year. The leading interest and the foremost independent in this territory have booked rails sufficient to insure a high rate of production in this department for the balance of 1923. In other departments, order books are well filled. The leading Chicago independent has not named its bar, shape and plate prices for the third quarter and probably will not do so until the first of July, according to information given out at the company offices here. A large tonnage ordered several months ago is still on the books of the leading independent and much of it cannot be produced until late in the third quarter.

Cincinnati Selling to Auto Makers

Automobile manufacturers are still in the Cincinnati market and are purchasing equipment in fair quantities, although there is a falling off in the number of orders which are actually being placed. Some of the machine tool manufacturers state that the railroads have been coming into the market in a stronger way than they have for months. Others are of the opinion that they have bought rather heavily during the past few weeks in sufficient volume to meet their immediate needs and that the railroads will not again be in the market to any extent for a considerable period of time.

In many instances orders have not fallen off although inquiries are fewer than they were. This is due to the fact that orders which have been in the process of negotiation for some time have actually been closed.

Manufacturers of upright and radial drilling machines report that they are receiving a smaller number of inquiries than they have for months and few orders are being booked. There has also been a let-down in the demand for lathes. Orders are not as numerous as they were, but inquiries are coming in in encouraging fashion and the outlook for the immediate future is good. Production milling machines are having good sales. Grinding machines have been selling better than milling machines according to the testimony of several manufacturers.

The market for electrical tools is fairly active. Foundries in Cincinnati are running approximately seventy-five per cent of their capacity.

Shops turning out sheet metal work and material going into the building trades are very busy. Inquiry for pig iron has increased slightly, but the limited orders being placed are mostly for fairly prompt or immediate shipments, officials announce.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.....	$0 034	$0.034	$0.0252
Cold finished shafting.....	per lb.....	0.042	0.042	0.0328
Brass rods.....	per lb.....	0.1850	0.1913	0.1533
Solder (½ and ½)	per lb.....	0.2862	0.2812	0.22
Cotton waste..	per lb.....	0.1231	0.1231	0.104
Washers, cast iron (¼ in.)...	per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100.....	3.08	2.96	3.11
Lard cutting oil	per gal.....	0.608	0.592	0.575
Machine oil....	per gal.....	0.349	0.349	0.383
Belting, leather, medium.....	off list.....	42½%	42½%	46¾%
Machine bolts up to 1 x 30 in.	off list.....	44¼%	44¼%	62¾%

Railroads Report Good April Earnings

April net railway operating income on Class I railroads, totaling $83,197,800, represents a return, on an annual basis, of 6¼ per cent of the Interstate Commerce Commission's tentative valuation, according to a statement made public by the American Railway Association.

In April last year the same carriers reported a net operating income of $49,979,000, equivalent to 3.99 per cent on the tentative valuation, while the net operating income for March this year was $83,487,000, or 5.96 per cent.

The April rate of 6¼ per cent is the highest return earned in any month since the passage of the Transportation Act of 1920. Operating revenues in April were $522,955,700, an increase of more than 25 per cent, compared with the same month of last year. Operating expenses totaled $403,869,000, an increase of more than 20 per cent over the same month of last year.

Eight-Hour Day Cheaper Experts Claim

Profits in steel plants need not suffer if the change from the twelve-hour to the eight-hour day is made with wisdom, said Dr. Harrison E. Howe of Washington, Chairman of the Committee on Work Periods of the Federated American Engineering Societies, recently. The committee, under the direction of Bradley Stoughton, professor of metallurgy at Lehigh University, recently made public the results of its investigation of the twelve-hour shift.

Dr. Howe said that labor costs in many cases had been reduced by the transition from the twelve-hour day to the eight-hour day. "The United States," he said, has the most profitable iron and steel industry in the world, making more money and yielding more output than all the rest of the world put together, and exporting its product in successful competition with foreign countries.

"The majority of managers and executives with whom the matter was discussed believe that the good of the industry can be better served by eliminating the twelve-hour day than by increasing dividends, provided that, by means of labor-saving devices and in other ways, this step can be taken without serious injury to the industry.

"The fact that already many plants operate successfully on the three-shift system indicates that profits need not suffer if the change is made with wisdom. The cost of all blast-furnace labor, according to either system, is less than $1 per ton of pig. Judge Gary testified before the Lockwood committee in June, 1922, that the United States Steel Corp. could produce at $2 per ton less than its competitors. This shows what low overhead and expert technical skill can accomplish.

"As a matter of actual experience, it is known that some plants have changed from the twelve-hour to the eight-hour shift and reduced their labor costs. Others have reduced their total manufacturing costs. Others are operating eight-hour shifts with satisfaction to management and stockholders."

Report on Welding Tests Compiled

For several years efforts have been made to draw up a code for the welding of unfired pressure vessels. Opinions of the best welding experts were not in agreement on many essential points. Fundamental, scientific knowledge, based on test data was not available. The American Bureau of Welding (Research Department of the American Welding Society), has completed a series of tests on some fifty tanks. The program involved an expenditure of over $15,000. The test data, analysis of same, conclusions and recommendations to the Boiler Code Committee of the A.S.M.E. have been compiled in a report, copies of which may be obtained from the American Welding Society, New York.

Problems of the German Machine Tool Maker

Labor and the government, stabilization of the mark and keen competition—Profits on declining currency and the export business—Efficiency at a low ebb

SPECIAL CORRESPONDENCE

WHEN foreign visitors come to Germany to investigate manufacturing conditions in order to get to the root of the main problem of interest, the German competition, they as a rule interview a number of people in authority, manufacturers and managers, trying to profit by their vast knowledge. This is quite natural. The German industry is working in an atmosphere too dense and opaque for people not used to it, so that they are quite unable to make out the correct shape even of quite familiar things. The mysterious gloom surrounding all objects causes hasty visitors to dwell on the surface of matters only, thereby arriving infallibly at erroneous conclusions or, if they are of a more scrupulous kind, to rely upon what they hear from sources, which they believe to be trustworthy. The opinions expressed in foreign countries on German industry are almost without an exception based upon such information and bear strong traces of it, even if they have been formed by an independent mind. If they are found conflicting with facts or with one another, it is ascribed to the individual view point of the informant. The visitor then tries to fit together the pieces of information as well as he can, presenting the result as the true and only solution of the puzzling problem.

Much Misinformation

Hardly ever has one of them tried to get behind the question, in what way his informants have arrived at their own opinion and from what sources they have drawn their own information. Faced by people in responsible position dealing it out frankly enough, they forget to be wary in this respect, not realizing that the mentality from which it comes is greatly different from what it was in pre-war times and from their own. They do not know, what resident observers know, that the Germans have during a prolonged time, since 1914, become the victims of a press, which has never moved far enough out of war-time practice to let them see things in a true light, unless it happens to be just the light, which the conductors of the public opinion wish them to see. In circumstances, where the unexpected usually happens, Germans have grown into a habit not to rely upon their own opinion, at least not to venture far away from the approved public opinion, except for a safe distance, which in the course of years has been steadily decreasing.

The public opinion has been and is in the habit of blowing hot or cold, dealing out optimism or passimism, just as the intentions behind it think expedient. The result is a most peculiar mixture of equally unwarranted sanguinity and depression in every individual in conflict with each other and with the individual's own personal conviction, which, however, hardly ever plays a prominent part in the conflict.

The information that the foreign visitor receives, honestly as it may have been given, is mostly colored, because there is no one in the country in possession of entirely unflavored information, unless he possesses supernatural powers of discernment. Most opinions formed in foreign countries should start from the thorough realization of these facts and those given should be revised accordingly.

The question of the German competition is a complicated problem, for which all the salient points should be considered in conjunction and not each separately. These points are the labor question, the supply of basic material, the state of equipment, management, the financial situation of the industry, and the relations between the industry and a Government, which may not be socialistic, but which by force of circumstances has to have socialistic leanings.

The Troublesome Mark

In estimating the German capacity of competition two distinct phases must be considered, that of a fluctuating or, to be more correct, a declining mark and that of a stabilized mark. It is irrelevant at what particular rate the mark will once be arrested, as the conditions ensuing therefrom will be identical in all cases.

It must be assumed that with a depreciating mark the German machine building industry will always be able to compete. True, the gains that the industry enjoyed from the money depreciation, have in the course of time somewhat diminished. Prices of basic material have found the world market level and are keeping it independent of the mark rate prevailing. Wages are adjusted in short proceedings instead of the former protracted red tape procedure. Still, as long as such an important factor as the mark rate is flexible, controlled more or less by the industry, the latter can always make both ends meet at any given time.

The Power of Industry

That the industry really controls the mark rate, can after recent experiences not be doubted any longer. The German industry represents the largest part of the country's financial strength, far exceeding that of the Government and of the State Bank combined. The export is the basis of this strength, and the proportionate forces become clear, when considering that of all export proceeds in gold only 25 per cent go to the Government, while 75 per cent remain with the industry. Every mark stabilization attempted so far must be considered in the light of a contest between the Government and industry, in which the latter has always come out topmost, almost as much richer as the state treasury has become poorer. It is an open secret, that the recent mark stabilization could only be maintained, as long as the industry consented to remain neutral, and that it collapsed when the manufacturers, finding their position untenable, changed their policy. It would be a mistake to single out certain prominent industrialists in connection with these matters. In nine cases out of ten, for names, like that of Stinnes, the National Association of German Industry should properly be substituted.

The question of German competition becomes a serious problem only, if the mark will once be stabilized, as it surely will. Then the labor problem will loom up high. Wages will settle down rather close to their pre-war equivalent, as past experience during comparative lulls in the mark fluctuation proves.

A ratio to the pre-war equivalent of about 50 per cent to which wages tend under present conditions, can be clearly recognized in spite of the breaks produced by a rapid movement of the mark rate. How close the ultimate ratio during a permanent standstill of the mark rate will be, is a matter of conjecture, but at least two solid reasons exist to presume, that it will be at about 60 or 70 per cent of the pre-war average, which ratio can be maintained for a considerable time. One of these reasons is the housing expense, which by the rent law is kept at a small fraction of pre-war average.

In March for instance it was 120 times higher than in pre-war years, while cost of living has risen by nearly 3,000 times. The other reason is the well-known frugality of the German workman.

Labor's Inefficiency

The advantage of the cheap labor, which the German manufacturer still will enjoy over foreign rivals, are, however, set off by reduced efficiency. To raise it to pre-war standard is, he declares, impossible under the restrictions placed upon him by labor legislation. This belief is well supported by facts, although not many have actually tried, having no need to, and a few have indeed quite succeeded. These were, however, purely exceptional cases, based upon paternal relations between employers and an old stock of hands. In the majority of cases, especially where large complements are concerned, attempts at speeding up work appear quite hopeless. Matters have got into such a rut that nothing but a radical change can restore a sound relation between what the workman expects to receive at a stabilized mark and what he is expected to give in return.

The workman is heavily protected at the expense of management. He can be dismissed only for reasons recognized by the employee's council. Slackness is not one of them, as long as it does not amount to gross idleness. Dismissal for lack of business is prevented by the demobilization ordinances still in force. In this case shortening of working time has to be resorted to.

The wages paid are the same for slow workers and hustlers. Piece work payment has been restored in some form, which is, however, a lame compromise only in as far as it guarantees the workman a certain minimum. The inducement necessary for utmost exertion is missing. There is not even an in-

ducement to acquiring full training, which is one of the sorest points of the situation. The differentiation between the workman's wages according to skill has narrowed in such a degree, that it has become almost nominal. The existing wages tariff for machinists recognizes three categories: skilled men, half-trained men and unskilled men. Married men receive small additional emoluments according to the size of their family.

Trained Hands Scarce

Trained, married hands, which is the highest paid category, are figured at 100 per cent, the others in the corresponding proportion. While in pre-war years a raw hand earned 35 per cent less than the skilled man, he gets now just 8 per cent less. It is probably the strongest testimonial of the discipline which socialistic doctrines have been able to establish in the ranks of the workmen, that this sort of levelling can be maintained in defiance of all economic rules and of the workmen's own better conviction. The consequence is, that full, apprenticed training in the younger generation is scarce, which explains the common complaint of lack of trained hands.

The efficiency of labor is not the only item of the cost problem. Waste in operation and management, expressed in the considerably swelled overhead, plays an equal, if not more serious part. Manufacturers are carrying a heavy burden of unproductive labor and expense, imposed upon them by legislation, to which most of them add something of their own, from sheer force of habit, combined with a failing sense of economy. Overhead, which before the war was in machine building generally calculated at 100 per cent, is now figured at 200 per cent or even more. Matters have not improved in this respect in the course of time, but rather the reverse has taken place.

Compared with pre-war conditions, most works are "top-heavy" as regards unproductive labor as well as personnel. Carl Friedrich von Siemens, president of the two Siemens electrical companies, a high authority on production, expressed himself recently at the annual meeting of his companies on this point as follows: "The swelling of our working force is only partly attributable to the increase of productive labor. Not until after the restoration of a stable scale of values will we be able to find out how much and in what places production has become more expensive compared with past years. We regret not to see a decrease, but rather an increase of the unproductive burden, and it does not look as if a return to healthier conditions could soon be expected."

Much Waste

Von Siemens put all blame on governmental measures. Although this is correct in a measure, the industry is doubtless accessory to it. Evidences of waste, which could easily be avoided, are visible everywhere.

What has been said about the works individually, is also true for business in general. There are now twice as many business firms in existence as before the war. It is a safe estimate that the floor space occupied by shops and offices has nearly doubled.

Lack of efficiency and ponderous methods have added a great deal of friction to the business machinery. Twice as many telegrams are being sent and nearly three times as many long distance calls are made in the intercommunication of the business world. Still, the total volume of production handled is on good authority 40 per cent less than what it was before the war.

A large part of the enormous amount of wasted energy, although not all of it, is certainly due to the guardianship, which the administration has assumed over business. Manufacturers have to install whole departments to cope with the fetters placed upon trade. The dispatch of a hand-sized sample to a foreign destination has become an effort. Shipping is now a matter, which in even small-sized works keeps several men busy, and on investigation it would be found, that a considerable percentage of railway passengers are business men traveling to the headquarters of export or import control trying to settle some point personally, which could not be settled by the numerous letters, telegrams and long distance calls that have already been used.

Chaotic Conditions

Considering these facts, the situation of the manufacturer is by no means as rosy as it appears from outside, judged by the level of wages alone. They dispel the common belief, that it is for the lesser wages the manufacturer pays, that he is able to underbid foreign rivals and still make a profit. This can be seen from a concrete instance. Taking for example a machine tool, which used to be sold at 2,000 marks and assuming the cost of labor for this machine to have been 600 marks, the latter figure would at a level of wages of 40 per cent compared with pre-war wages be 240 marks. The ratio of efficiency of 60 per cent will bring this sum up to 400 marks. While in pre-war times the manufacturer added 100 per cent to the amount of wages for overhead, he has to add now 200 per cent, which makes the result in both cases identical. The 60 per cent efficiency must of course not be generalized, but it doubtless applies to the majority of cases. There are firms working with as much as 80 per cent efficiency. It would be a similar mistake to generalize from the most favorable cases, as it is frequently done, they being identical with the prominent firms which more or less hold the attention of observers, while the general run is overlooked.

The foundation of the German competition is, therefore, not the lower level of wages that are being paid. The real bonanza time of the German manufacturer was, when every item of cost kept in proportion with the wage level, some of them, like transportation, even far below. This was the time, when the control of basic prices permitted to maintain a wide margin between German and foreign prices of all commodities, when the manufacturer could build his machines at the low domestic prices and sell them abroad in an entirely different atmosphere of values. This time is now irrevocably past.

Control of basic prices has broken down. The German manufacturer can no longer buy his iron and steel and other basic material cheaper than his foreign rival, sometimes he has to pay even more. The chief advantages that the German manufacturer now enjoys are the downsliding mark rate and the credit system. How the former works out in practice can be seen from the following example: Taking for instance the case of a machine tool ordered last June at a price of 100,000 marks to be completed and delivered in 6 months. According to the scale of sliding prices the definite purchase price would in November have been 1,575,000 marks. Assuming that the manufacturer figured his cost at 72 per cent of the purchase price and that this cost, increasing according to the sliding of prices, would be expended in equal portions during the six months of completion, the goldmark equivalent of the cost at the monthly mark rate prevailing would amount to the following:

Adding Profits

First month, 160 goldmarks; second month, 134 goldmarks; third month, 84 goldmarks; fourth month, 152 goldmarks; fifth month, 130 goldmarks; sixth month, 114 goldmarks; total 774 goldmarks.

If the mark had remained stable, the cost would have amounted to 960 goldmarks; the debasement of the mark has brought it down to 774 goldmarks. On the other hand, the gold equivalent of the purchase price of 100,000 marks was in June 1,340 goldmarks and that of the ultimate purchase price of 1,575,000 marks was in November 940 goldmarks. The margin of profit on a domestic order has, therefore, narrowed in spite of the decreased expenditure, that on the foreign order, however, appears considerably increased. The presumptions made for the above calculation were, however, far less favorable than in reality. The manufacturer receives payment on account, which he turns at once into gold currency. Besides he pays with the debased currency of one month liabilities contracted in the previous months. This applies also to wages which, as a rule, follow the price movement in intervals of more than one month. The manufacturer is further greatly assisted by a credit system, by which—allowing him to raise German marks on his credit balance of foreign money as a collateral, which liability he can discharge with a depreciated currency—he makes a large extra profit. This explains, why the manufacturer feels every improvement of the mark rate, even a comparative standstill, at once as a squeeze upsetting all his calculations and swallowing his profits.

Conflicting Convictions

Much has been said about the profits of the German manufacturers. The wealth supposed to have been accumulated in industry plays an important part in the reparation problem. The German manufacturers maintain, that in spite of their apparent prosperity they have become poorer, while many people inside and outside of Germany are convinced, that huge profits have, indeed, been amassed by the industry. Judging from outside, the former contention appears well supported by fact. The 5,500 corporations, which existed in 1913 and which represented the larger part of the German industry, had in that year a nominal capital of seventeen billion marks with a marketable value of thirty billion marks. The approximately 10,000 corporations existing now represent, however, on the ground of the quoted value of their shares a sum of four billion goldmarks only.

On the other hand, there is no shadow of a doubt, that the stock exchange

valuation of German industrial stock is much too low and has been kept down by the small dividends paid. It is well known that the prosperous German corporations do not draw their balance sheets in the customary fashion, balancing revenue and expenditure, thereby arriving at the business result, but instead decide first, which profit to show and adjust the balance sheet accordingly. It is also well-known that the dividends represent only a fraction of the real earnings and that a by far larger part of them has been and is being used for extension and for keeping the assets at their gold value. The estimate may be permitted, that, while the German industry has not enriched itself in the absolute sense of the term, it has not become poorer. The gold capital has in the whole remained intact. There are still quite a number of German corporations which have not raised their capital at all. The majority of corporations have increased their capital stock, but only in a safe proportion to increased assets. Real watering of stock is very rare.

In spite of these facts, the situation of the manufacturer in the event of a mark stabilization will be a very precarious one. The recent mark stabilization has been an object lesson. Prices are as a rule purely arbitrary and adjusted by the associations, which are now acting in the capacity of a sort of sales trust, in a fashion, which will allow the last straggler to still make a profit. They are not the result of calculation, and it is safe to say that there is hardly a machine manufacturer in the country who is aware of how much a particular machine has cost him to produce. This stands in the way of a quick adjustment to changed currency conditions. The manufacturer does not know, down to what level he can cut his price without actual loss.

Reducing the Cost

Such considerations are only of the most immediate importance. The chief problem to the manufacturer will not be a reduction of prices at a given standard of cost, but the reduction of cost itself. In this respect he will be faced by a steep uphill proposition. The development, as it will ensue in the case of a mark stabilization, depicts itself in the mind of manufacturers as follows: The first consequence will be stagnation of business, growing unemployment, which will give the industry the upper hand in the labor question. Labor will have to accept the industry's conditions or there will not be any work. The aim is to restore pre-war labor conditions, abolish the eight-hour day and re-establish pure payment by results.

The contingency, that labor should not acquire the dictates of industry, is not seriously taken into consideration. The chances are indeed, that matters will take a peaceful course, seeing how feeble the resistance of labor has already become and how near the abolishment of the eight-hour day, the chief bulwark of the labor movement, had at one recent time already been approached. A strong Government would, of course, be needed to carry out all these changes. The manufacturer is of the opinion, that such Government would be forthcoming after the reparation problem is settled, and that it will be one, in which the industry will be amply represented.

The difficulties will, however, not end there. It is an admitted fact, that the efficiency of management has greatly depreciated, that the German engineer is not nearly what he used to be. The psychosis created during the war, hardly ameliorated in the semi-warlike conditions thereafter, shows itself in the one important respect, that no German engineer seems to be able to approach any given problem with a fresh mind. This is clearly visible in the technical development of post-war times, in which originality and radically progressive spirit are peculiarly absent. The equipment of the shops is comparatively more advanced than it was in pre-war times. The progressive firms have in this respect made considerable headway. The layout of work and the general operation is, however, greatly at fault almost everywhere. Alertness in the matter of waste of time and material is missing.

German Deficiencies

The deficiencies in German manufacturing are now recognized almost everywhere. Hardly any manufacture fails to realize, that in the event of a stabilized mark, the German industry will be outrivalled for a considerable time. To achieve the radical readjustment needed, a period from one to two years is commonly expected to be required. The extension of the working time is a matter, which in manufacturing will at first be hardly of any real value. For the cheaper production of raw material, especially the exploitation of the country's natural resources, it is, however, of the greatest importance.

For manufacturing other measures are contemplated, in fact, a complete plan has already been evolved by the men acting as technical advisers of the Government. The chief part of this plan is formed by a general adoption of all standardized parts, made compulsory by law. The advisers of the Government are specially strong on this point. A start to be made is indeed already in contemplation with regard to the motor car industry. It is expected that thus the way to extensive quantity production will be opened, and that the German machine tool builders will step in and cut down working time to the utmost limit.

The task, by which the German manufacturers are faced, is indeed a formidable one. During almost nine years there was hardly ever a time, when they had the least trouble about selling their products. The lassitude created during these nine years is enormous, and an iron heel will, indeed, be needed to stamp it out. But if this iron heel is once set on its march, the chances are, that the manufacturers, no matter how much they will be writhing in worries, will find a way through. This at least is the impression gained from the vitality, thoroughness and industriousness of the whole population.

Pamphlets Received

Facts and Figures of the Automobile Industry. National Automobile Chamber of Commerce, New York City. The growth, development and possibilities of the industry are told by statistics and description in an excellently prepared booklet recently issued.

An Investigation of the Fatigue of Metals. University of Illinois. A report on the findings of the investigation by H. F. Moore and T. M. Jasper. A review of this pamphlet appears elsewhere in this issue of the *American Machinist*.

List of Associations and Publications. The Chamber of Commerce of the State of New York. All associations in the city of New York and the trade publications relating thereto are listed in a pamphlet recently issued by the above named association.

Annual Report of the Statistics of Manufactures in Massachusetts. Department of Labor and Industries of Massachusetts. Listings of industries, comparison by localities, comparison by ownership, wages paid, hours employed and all data pertaining to manufacture are to be found in this recently published pamphlet.

Air Service Information Circular. Published by the Chief of the Air Service, Washington, D. C. The results of an investigation of the effects on cylinder performance of variation of position and number of spark plugs is contained in Vol. 5, No. 401 recently published.

An Investigation of the Properties of Chilled Iron Car Wheels. By J. M. Snodgrass and F. H. Guldner. Published by the University of Illinois. Part 3 of this subject pertains to the strains due to brake application co-efficient of friction and brake-shoe wear.

Gage Steel Investigation. Bureau of Standards, Washington, D. C. Communication No. 8 deals with the interior structure of hardened gage specimens.

Patents. Richard & Geier, New York. Patents and how they are obtained and protected are fully described and explained in this pamphlet issued by these patent and trade-mark attorneys.

Trade-Marks. Richards & Geier, New York. Trade-marks, trade-names and unfair competition are treated in the pamphlet on this subject recently issued.

Seventy-Five Years of Constant Growth. Hammacher, Schlemmer & Co., New York City. An attractive booklet showing the development of this concern since its inception three-quarters of a century ago has recently been published.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Burners for boilers using mazoute and heavy oils for fuel. Charlon-sur-Saone, France. Purchase and agency. Reference No. 6610.

Automobile cylinder grinding machines. Montevideo, Uruguay. Purchase. Reference No. 6612.

Visible gasoline pumps. Riga, Latvia. Purchase. Reference No. 6705.

Sheet-metal working machines. London, England. Agency. Reference No. 6611.

Small powered woodworking machinery. Alexandria, Egypt. Agency. Reference No. 6613.

Forthcoming Meetings

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

American Society for Testing Materials. Annual meeting at Atlantic City, June 25 to 29, Chalfonte-Haddon Hall. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

Section V Mechanical of the American Railway Association. Annual meeting at Orchestra Hall, Chicago, June 20, 21 and 22. V. R. Hawthorne, 431 South Dearborn St., Chicago, secretary.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit during the month of September, New Haven, Conn.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Steel—Heavy buying of steel rails at Pittsburgh mills; car materials, tank and ship plates also in demand. Production continuing at high rate with improvement in mill shipments. Demand assuming conservative proportions as better deliveries induce buyers to show less concern over forward requirements. The $2.50 base holding firm for structurals; maximum on plates, $2.60 per 100 lb. for prompt deliveries. Bars at minimum of $2.40, f.o.b. Pittsburgh.

Advances—Flint cloth and paper, also emery cloth and paper sheets and discs, advanced somewhat during month. No other important advances.

Declines—Pig iron prices easier, despite recent heavy consumption. May output heaviest on record; production in gross tons per day, 5 per cent heavier than April record. Steel sheets down 25c. per 100 lb. at Pittsburgh mill. Lead down 10c. and zinc, 5c. per 100 lb. in New York, during week; antimony also cheaper. Washed white wiping cloths at minimum of 10½c. per lb. Maximum on furnace coke down 75c. per ton. Lead decline due to falling off in paint trade; zinc, to decrease in demand.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	30.77
Southern Ohio No. 2	31.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36 75
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.26
Virginia No. 2	34.17
Basic	28.26
Grey Forge	28 76
CHICAGO	
No. 2 Foundry local	32.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	30 77
Basic	29.27
Bessemer	30.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 l

Detroit	6.50
Cleveland	5.60@6.25
Cincinnati	6.75
New York	5.50@5.75
Chicago	4.00@5.00

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00@3.25	4.59	3.90	4.15
No. 12	3.10@3.35	4.64	3.95	4.20
No. 14	3.20@3.45	4.69	4.00	4.25
No. 16	3.40@3.65	4.79	4.10	4.35
Black				
Nos. 17 and 21.	3.70@3.85	4.95	4.55	4.85
Nos. 22 and 24.	3.75@3.90	5.00	4.60	4.85
Nos. 25 and 26.	3.80@3.95	5.05	4.65	4.90
No. 28	3.85@4.00	5.15	4.75	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00@4.25	5.15	4.80	5 10
Nos. 12 and 14.	4.10@4.35	5.25	4.90	5.20
Nos. 17 and 21.	4.40@4.65	5.55	5.20	...
Nos. 22 and 24.	4.55@4.80	5.70	5.35	5 65
No. 26	4.70@4.95	5.85	5.60	5 80
No. 28	5.00@5.25	6.15	5.90	6.10

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	62	50½	¼ to 1½	30	13
			LAP WELD		
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
			BUTT WELD, EXTRA STRONG, PLAIN ENDS		
1 to 1½	60	49½	¼ to 1½	30	14
2 and 3	61	50½			
			LAP WELD, EXTRA STRONG, PLAIN ENDS		
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50@8.00	8.00	7.35
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.30
Cold finished flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.32½
Soft steel bar shapes (base)	3.54	3.36	3.32½
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.71	3.40
Bar iron (3.25 at mill)	3.34	3.36	3.32½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%
Electric welding wire:			
⅝	8.50		14.00
½	7.35		12.25
5/16 to ¼	7.10		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.62½
Tin, 5-ton lots, New York			43.62½
Lead (up to carlots), St. Louis	7.00;	New York.	7.62½
Zinc (up to carlots), St. Louis	6.30;	New York.	6.80

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-ton lots	26.20	28.00	28 50
Antimony (Chinese), ton spot	8.00	10 50	8.75
Copper sheets, base	25.50	24.25	23 00
Copper wire (l.c.l.)	18.12½	21.00	16 25
Copper bars (l.c.l.)	22.50	24.25	19.50
Copper tubing (l.c.l.)	27.00	29.25	23.00
Brass sheets (l.c.l.)	20 50	24.25	18.75
Brass tubing (l.c.l.)	25.50	29.75	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (l. c. l.)	18.75	21.00	15.75
Brass wire (l. c. l.)	21.00	22.00	.....
Zinc sheets (casks)	11.00	10.40	.....
Solder (½ and ½), (caselots)	31.50@33.50	29.50@31.50	20.00
Babbitt metal (83% tin)	60.00	52.00	41.00
Babbitt metal (35% tin)	35.00	17.50	18.00
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	35 00
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	13.00	14 00
Copper, heavy, and wire	13.25@13.75	12.00	13 00
Copper, light, and bottoms	11.25@11.75	10.00	12.00
Lead, heavy	5.00@ 5.50	5 00	6.25
Lead, tea	4.50@ 4.75	4.00	5.25
Brass, heavy, yellow	7.50@ 7.75	....	8.50
Brass, heavy, red	11.00@11.50	10.00	10.50
Brass, light	6.00@ 6.50	5.50	7.00
No. 1 yellow brass turnings	7.50@ 7.75	6.50	7.75
Zinc	3 75@ 4.25	3.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	23.50	19.50	18.50
IX,	20x28, 112 sheets	26.00	22.25	20.90
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
IX,	20x28, 112 sheets	23.50	19.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	14.00	12.60	14.50
IC,	112 sheets	14.30	13.00	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	8.00	6.65	7.25
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb.	10.25@11.25	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	3.50	2.65
Roll sulphur, per 100 lb.	2.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.16	1.30	1.37
White lead, dry or in oil	100 lb. kegs.	New York,	14.50
Red lead, dry	100 lb. kegs.	New York,	14.50
Red lead, in oil	100 lb. kegs.	New York,	16.00
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.50@5.25	
Coke, prompt foundry, Connellsville	per net ton	6.00@7.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅝ and smaller	60%	.....	...
Semi-finished nuts, ¾ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3 50
Washers, round plate, per 100 lb. Off list	1 50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	40%	50-10%	60 %
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ga., Thomasville—Thomasville Iron Wks. —machine shop equipment, including lathe, drill, press, welders, etc.

Ill., Chicago — Chicago, Rock Island & Pacific R.R., La Salle St. Sta., F. D. Reed, Genl. Purch. Agt.—one motor driven 48 in., swivel head, turning and boring mill; one motor driven 36 in. engine lathe.

Ill., Springfield—Weaver Mfg. Co., 2171 South 9th St. (machinists)—machinery and equipment for addition to plant.

Ill., Waukegan—S. Schwartz, 927 North Sheridan Rd. — grinder, air compressor, gasoline storage tank and pump for garage.

Kan., Caldwell — N. Berdan & Son (garage)—power cylinder grinder.

Kan., Caldwell—Le Cocq Motor Co.—power cylinder grinder (used).

Kan., Caldwell—Standard Specialty Co. (manufacturer of metal signs), J. Ryland, Purch. Agt.—power drill press and tinners brake.

Kan., Derby—C. Alley—power metal lathe for garage.

Kan., Mulvane—C. Parker (garage)—power lathe, power drill press and belting.

Kan., Mulvane—F. Smith—power metal lathe for garage (used).

Kan., Wichita—C. B. Wilson, 1212 Carlos St. (machine shop)—power metal lathe, drill press, emery wheel with stand, belting and hangers (used preferred).

Ky., Owensboro—Owensboro Clay Products Co., c/o J. A. Bolger—machine shop equipment.

Mass., Boston—Edison Electric Illuminating Co., 39 Boylston St.—complete equipment for proposed $25,000 machine shop.

Mass., Boston—Simplex Wire & Cable Co., 201 Devonshire St.—machine shop equipment.

Mass., Newburyport—Chase-Shawmut Co. (machine and forge work), F. N. Conant, Purch. Agt.—medium size spot welder (used).

Mich., Detroit—M. R. Search, 3513 Wabash Ave. (sheet metal working shop)—8 ft. cornice brake, turning machine, burring machine, mandrel stakes and hand punch (used preferred).

N. Y., Binghamton—Quality Tire Shop, 144 Court St., A. Chadwick, Purch. Agt.—engine lathe to mount wire brushes for rubber cleaning and scoring.

N. Y., Buffalo—C. Dettman, 137 Eaton St.—equipment for automobile repair shop at 295 Fillmore Ave.

N. Y., Canastota—F. Hayes, Mill St. (blacksmith and forgings)—castings, etc., for built in forge with electric blower, also power operated angle shear.

N. Y., Canton—A. Perry, Gouverneur St. (garage and repair shop)—one bench miller (new or used).

N. Y., Canton — St. Lawrence Garage, Main St., D. Sullivan, Purch. Agt.—20 in. vertical drill press, also one 180 lb. press, air compressor and tank.

N. Y., Elmira—Melvin Garage, High and Water Sts.—machinery, tools and equipment, including press, drill, lathe, grinders, etc., for proposed $55,000 garage and service station.

N. Y., Jamestown—C. A. Nelson, R. F. D. 75—gasoline and service station machinery, tools and equipment.

N. Y., Owego—W. M. Miller Co., Main St. and Central Ave. (garage and machine shop)—220 volt portable electric drill, also tool makers lathe (new or used).

N. Y., Sacket Harbor—Markham & Lepper Co., Broad St. (machine shop and garage), H. Markham, Purch. Agt.—4 x 4 in. power operated metal saw.

O., Newton Falls—E. Gates, c/o Gates Motor Service—garage and service station machinery, tools and equipment.

O., Youngstown—A. H. Dillon, Stambaugh Bldg.—complete machinery and equipment for the manufacture of all steel refrigerators.

Okla., Medford—Armstrong Bros. Mfg. Co., D. A. Armstrong, Purch. Agt.—cylinder grinder and power metal lathe for machine shop.

Okla., Medford—G. H. Belcher Motor Co. —power lathe and drill press (used).

Okla., Medford — Medford Battery & Electric Co., W. B. Hula, Purch. Agt.—power drill press.

Okla., Medford—C. A. Peare—drill press, lathe, belting, emery stand and wheel for garage.

Okla., Medford—F. A. Warzyn—power drill press, lathe and cylinder grinder for garage.

Okla., Pondcreek—N. T. Dryer—tinners brake (used).

Okla., Pondcreek—R. F. Viggs—power metal lathe, power drill press, emery wheel, stand, belting, motor, hangers, shafting and pulleys for garage.

Pa., New Castle—J. Matson, North St.—machinery, tools and equipment for Cadillac garage and service station.

Tex., Dallas—Briggs & Co., 3815 Parry St.—power metal lathe, power drill press, hand tools, hangers, belting, pulleys and bearings for machine shop.

Tex., Waco—W. G. Gilmore, 703 North 6th St.—30 in. tinner's square shear.

Va., Richmond—Anderson Motor Co., 1815 West Broad St.—drill press for automobile repair work.

Va., Richmond—D. L. Claville, 906 East Cary St.—lathe and cylinder boring machine for automobile repair work.

Va., Richmond — Franklin Motor Co. (automobile repairs), 2007 West Broad St. —arbor press.

Va., Richmond—R. S. Gilson, 1811 West Broad St.—lathe, emery wheel and stand for automobile repair work.

Va., Richmond—Johnson Eary Comp. Co., 1801 West Broad St.—drill press and lathe for automobile repairs.

Va., Richmond—Owens Motor Co., 2100 West Broad St. — reboring machine and welding outfit.

Va., Richmond — Public Garage, 1814 West Main St.—lathe for automobile repairs.

Va., Richmond—Richmond Battery Co., 1339 West Broad St.—drill press.

Va., Richmond—Stebbin & Pauli Corp., 2102 West Broad St. (automobile repair work) — machine for finishing magnalite pistons.

Wis., Antigo—Kelley Auto Sales Co.—automobile repair machinery, including press, gasoline tanks and pumps for proposed $40,000 garage.

Wis., Milwaukee—A. J. Uchitil, 682 Madison St. (manufacturer of vulcanizers) — small drill press, grinder and electric motors.

Wis., Milwaukee—J. Vaudreul, 382 10th St. (machinist)—medium size drill press, belting and shafting.

Ont., Alexandria—Central Garage, Ltd., J. R. MacDonald, Purch. Agt.—additional equipment for automobile repairing.

Ont., Toronto — Toronto Transportation Comn., 35 Yonge St., H. H. Couzens, Mgr.—lathes, drills, borers, jackhammers, air tools, etc., for repair shops.

Que., Granby—Garage Drolet de Granby, Ltd.—repair equipment.

Que., Montreal — Corry & Leonard, 252 Lagauchetiere St., W., A. Leonard, Purch. Agt.—equipment for motor and dynamo repair shop.

Que., Montreal—D. Paquette, 1176 de la Roche St.—equipment for garage and automobile repair shop at 135 De Normandie St.

Que., Montreal—D. Rabow, 2626 A St. Urbain St.—equipment for automobile repair shop.

Que., Montreal—P. Swail, 57 Coursol St. —complete equipment for automobile repair shop.

Que., Richmond—Weir & D'Almaine, J. R. Weir, Purch. Agt.—automobile repair and additional machine shop equipment.

Que., Rock Island—O. F. Ticehurst—repair equipment for garage.

Que., Verdun—J. N. Reid, 198 1st Ave.—complete equipment for automobile repair shops.

Machinery Wanted

Ala., Elba—W. H. Cauley—sawmill machinery and equipment.

Ala., Sylacauga — Bd. Educ. — complete manual training equipment, including lathe, drill press, transmission and conveying machinery, small tools, etc.

Ark., Camden—Morris Oil Co.—complete machinery and equipment for proposed $250,000 refinery, capacity 3,000 bbl. per day.

Ark., West Helena—Superior Oak Flooring Co.—machinery and equipment for large addition to oak flooring manufacturing plant.

Conn., New Haven—C. Roessler, 60 Pearl St.—refrigerating machinery.

Fla., Jacksonville — W. A. Connacher, Pres., 442 North 7th St.—box making machinery.

Ga., Fitzgerald—Union Cotton Oil Co.—additional cotton oil making machinery and equipment for $50,000 plant.

Ill., Chicago—H. J. Delson Co., 749 North Western Ave., P. Delson, Purch. Agt.—14 x 22 in. Universal job press.

Ill., Chicago—J. Schmidt, 1249 North Clark St.—acetylene welder, cutting torches and boiler shop tools.

Ill., Freeport—Arcade Mfg. Co., 1 Columbus Ave.—foundry equipment.

Ind., New Albany—Gohman Bros. & Kohler—foundry equipment.

Kan., Caldwell—Andrews & Viele (cabinet makers)—Universal saw and power sander (used).

Kan., Caldwell—J. E. Halfert, 406 South Main St.—power leather stitcher and nnisher for shoe shop.

Kan., Eldorado—O. Kistler, 308 North Summit St.—electric automatic air compressor.

Kan., Fort Scott—W. E. Brooks, c/o The Brook Co. (oil, feed and grain)—equipment for filling station, including two large gasoline pumps, air compressor and steel tanks for gasoline and air.

Ky., Louisville — Buckley Bros., Engrs., Starks Bldg.—flour milling machinery.

Ky., Louisville—Office of United States Engineer—one portable belt conveyor with troughed belt for lift of 10 to 12 ft. Estimated cost $700.

Ky., Louisville—St. Joseph's Infirmary, 4th St.—machinery for proposed $60,000 laundry.

Ky., Morganfield — Morganfield Coal & Coke Co.—coal mining equipment, including steam hoists, fans and pump. Estimated cost $25,000.

Ky., Owensboro—J. Rose & Co.—complete tobacco drying and processing equipment for plant at Kingsville, Ont.

Mass., Boston — Howes Mfg. Co., 263 Northampton St. (manufacturer of fire doors, etc.)—chain mortiser and side sticker machine, also kalamein door machinery and equipment (new or used).

Mass., Gardner — Buffington Co., F. Buffington, Berkshire, Purch. Agt.—woodworking machinery and equipment for the manufacture of patented folding chair for proposed factory, to contain 10,000 sq.ft. of floor space, at Owego, N. Y.

Mass., New Bedford—Allen Woodworking Corp., 3 East Pope St.—several band and circular saws, various sizes, also planers, matchers, lathes, drills, tables, benches, pulleys, shafting, motors, etc., for new shop.

Mass., Walpole—Trustees of the Norfolk County Agricultural School—woodworking and shop tools, including lathes, planer, drills, reamers, bandsaws, circular saws, tables, benches, etc.

Mich., Detroit—Detroit Lubricator Co., 5938 Trumbull Ave.—miscellaneous equipment for proposed factory.

Mich., Highland Park—Ford Motor Co.—equipment for billet, chipping, blooming and merchant mills, also for soaking pit.

Minn., Minneapolis—G. R. Newell & Co. 1st Ave. N. and 3rd St. (wholesale grocers), L. B. Newell, Purch. Agt.—refrigerating machinery for new 5 story, 122 x 149 ft. warehouse.

Mo., Kansas City—Rothschild & Sons, Main and 10th Sts., L. P. Rothschild, Purch. Agt.—Universal woodworking machine and power wood lathe.

N. H., Berlin—School Com.—tools, including lathes, planers, matchers, drills, saws, tables, benches, etc., for manual training department of proposed $200,000 to $300,000 high school.

N. J., Mantua—Scott Lumber Co.—lumber plant machinery, including planers, saws, etc.

N. Y., Binghamton—Payne & West Co., 11 Collier St. (welding and brazing)—heavy duty acetylene welding outfit and equipment.

N. Y., Binghamton—W. M. Sharp Mfg. Co., 41 Wall St. (plating works), C. T. Kinsman, Purch. Agt.—additional nickel plating machinery and equipment.

N. Y., Buffalo—F. Anner, 223 William St.—candy and ice cream making equipment for factory at 1114 Abbott Rd.

N. Y., Buffalo—Belter & Geiselhart, Kenefick Ave.—machinery for the manufacture of sausage.

N. Y., Buffalo — Bd. Educ., 1401 Telephone Bldg.—receiving bids until June 23 for manual training equipment, including wood turning lathes, grinders, sheet metal and iron work for various elementary schools.

N. Y., Buffalo—W. A. Fage, 232 Monroe St.—equipment for dairy at 1902 Bailey Ave.

N. Y., Buffalo—Houdaille Co., 1400 West Ave., J. A. Graham, Purch. Agt.—machinery for the manufacture of leather coverings for automobile springs, for plant at 216 Forest Ave.

N. Y., Buffalo—C. Lombardo, 179 Front Ave.—equipment for bakery and for the manufacture of confectionery.

N. Y., Buffalo—C. T. Macris, 121 Heath Ave.—candy making equipment for factory at 120 Norwalk Ave.

N. Y., Buffalo—G. R. Niles, 116 May St.—candy making equipment for small factory at 9 West Utica St.

N. Y., Buffalo—C. Notarantonia, 1520 East Delevan Ave.—equipment for the manufacture of soft drinks for small factory on East Delevan Ave. and Freund St.

N. Y., Buffalo—W. Preiss, 725 Sycamore St.—bakery equipment for proposed plant at 841 Clinton St.

N. Y., Buffalo—Synthe-Copal Co., Inc., 994 Seneca St.—equipment for the manufacture of varnish gum for proposed $14,000 factory.

N. Y., Canandaigua—Genesee Stone Products Co.—additional stone crushing machinery and equipment.

N. Y., Charlotte—Fruit Growers' Syndicate—machinery and equipment for $150,000 cold storage plant.

N. Y., Elmira—Chemung Fdry. Co., 500 Erie St., B. Rathbun, Dir.—equipment for addition to foundry.

N. Y., Elmira—Dunn-Cooper Corp., Madison Ave. and Water St.—machinery and equipment for addition to pattern works.

N. Y., Elmira—J. L. Ward, Judson and East Church Sts.—complete brass foundry equipment.

N. Y., Jamestown—Jamestown Lounge Co., Winsor St.—woodworking machinery and equipment.

N. Y., Jamestown—Pennzoil Oil Co., Steel St.—equipment for gasoline and service station at Maysville.

N. Y., New York—A. Loewy, 200 5th Ave.—one baling press.

N. Y., Niagara Falls — Niagara Falls Arena, Inc.—60 ton ice manufacturing machinery and equipment.

N. Y., Penn Yan—Penn Yan Lumber Co.—lumber mill machinery and equipment, including saws, planers, transmission and conveying machinery, etc., to replace that which was destroyed by fire.

N. C., High Point—Giant Furniture Co.—complete woodworking machinery and equipment, to replace that which was destroyed by $150,000 fire.

N. D., Fargo—State Bd. of Administration, Gardner Hotel, E. G. Wanner, Secy.—receiving bids until June 27 for coal and ash conveying machinery for State Hospital for Insane at Jamestown.

O., Lowellville—Grasselli Powder Co.—press, corning mill machinery and equipment, to replace that which was destroyed by explosion.

O., Portsmouth—Ohio Stone Co.—stone crushing machinery and equipment for addition to plant.

O., Ravenna—A. C. Williams Co. (foundry)—machinery for proposed additions to plant.

Okla., Hydro—R. Hardy (harness maker)—power shoe finisher.

Okla., Hydro — O. Smith—power shoe finisher.

Okla., Pondereek—M. B. Cook, Main St.—(harness, leather and shoe repair)—power Landis leather stitcher combination machine and dustless power leather finisher.

Okla., Pondereek—L. Thomas—power job press with Miller feeder.

Pa., Barnes—Clawson Chemical Co.—charcoal screening machinery.

Pa., Beaverdale—Bd. Educ.—vocational equipment, including drills, press, lathe, tools, transmission and conveying machinery for $100,000 school.

Pa., Birdsboro—Birdsboro Stone Co.—stone crushing machinery and equipment.

Pa., Butler—Bish & Forrester, Jackson St. and Waverly Way—gasoline tanks, pumps and air compressor for garage.

Pa., Charleroi — Youghiogheny & Ohio Coal Co.—coal tipple machinery and equipment.

Pa., Delta—Blue Mountain Stone Co.—complete machinery and equipment for the manufacture of slate granules for roofing.

Pa., Gettysburg—Auburn Shale Brick Co. complete brick making machinery and equipment for addition to plant.

Pa., Greensburg—Fisher Traffic Co.—ice making and cold storage equipment for plant at Jeannette.

Pa., Nanticoke—Susquehanna Collieries Co.—coal mining machinery and equipment, including transmission and conveying machinery, drills, etc.

Pa., New Oxford—New Oxford Shoe Co. machinery and equipment for new 2 story shoe factory.

Pa., Phila.—J. Boggs, 1828 East Wishart St. (cabinet maker)—power woodworking machinery, belting, hangers, saws, planer and sanders.

Pa., Phila.—Fretz Moon Tube Co., 23rd and Sedgly Sts.—blast furnace and machinery (new).

Pa., Williamsport — Keystone Iron & Metal Co., foot of Locust St.—horizontal gag press or bulldozer for breaking rails.

Pa., York—Martin Parry Body Corp.—complete machinery and equipment for automobile body plant at Pittston.

Tenn., Cookeville—Putnam Mining Co.—coal mining machinery.

Tenn., Johnson City—Camp Branch Coal Co., S. Jenning, Pres.—coal mining machinery, shakers, screening, cutting and sorting machinery.

Tex., Floydada—Bd. Educ.—vocational equipment for $90,000 school.

Tex., Gladewater—B. F. Phillip—oil and waste saving equipment.

Tex., Junction — Bd. Educ. — vocational equipment, including lathe, drill, saws, press, etc., for $85,000 school.

Utah, Salt Lake City—Salt Lake Barber Supply Co., 25 East South St.—automatic paper knife grinder with power attachment.

Va., Lynchburg—Bd. Educ.—vocational equipment for $100,000 school.

Va., Richmond—Chesapeake & Ohio Ry., 825 East Main St., R. M. Nelson, Purch. Agt.—two 20 ton locomotive cranes for Huntington, W. Va.

W. Va., Charleston—W. S. Fulton, 433 Masonic Temple—hydraulic press.

W. Va., Gilmer—Quaker Coal Co.—coal mining machinery and equipment, including transmission and conveying equipment.

W. Va., Inwood—H. W. Prettyman—250 ft. roller conveyor with rollers 4 in. x 2 ft.

W. Va., Sistersville—Bd. Educ., W. J. Neuenschwander, Purch. Agt.—vocational equipment for present high school.

Wis., Grantsburg—Wood River Creamery Co.—churns, separators, testers, belting and shafting for proposed creamery.

Wis., La Crosse—E. J. Jacobson, 833 Rose St.—gasoline storage tanks and pumps for proposed filling station.

Wis., Lomira—Lomira Mfg. Co. (manufacturer of woodwork and furniture), W. E. Muir, Purch. Agt.—planer, power saw, etc.

Wis., Milwaukee—C. W. Harbst, 941 21st St.—siding machine, vamper, eyelet machine, stitchers, etc., for the manufacture of shoes.

Wis., Milwaukee—Snow White Wet Wash Laundry, 665 Smith St., A. H. Sharping, Purch. Agt.—power mangle, mechanical dryers and power washers.

Wis., North Milwaukee—E. Korth, Route 5 (carpentry and millwork)—one tilting saw table to take 12 in. saw, also one 20 to 24 in. bandsaw.

Wis., Platteville—Kistler-Stephens Co.—special machinery, extractors, conveyors, etc., for proposed $50,000 zinc mill at Benton.

Wis., Rhinelander—Rhinelander Electric Light Co., E. A. Forbes, Mgr.—15 ton electric crane.

Wis., Shiocton—Big Wolf Kraut Co., c/o G. H. Lonkey—shredding machines, conveyors, belting and shafting for proposed $45,000 sauerkraut factory.

Wis., South Milwaukee — Mid-Western Shoe Mfg. Co., c/o S. Doerman, 1612 Lake Ave.—electrically driven shoe working machinery for proposed $50,000 factory on Michigan Ave.

Wis., Superior—Superior Wood Products Co., 102 Hughitt Ave. (manufacturer of furniture, etc.), G. Carlson, Purch. Agt.—bandsaw and glueing equipment.

Alta., Coutts—Sunburst Refinery Co., L. C. Stevenson, Pres.—complete plant for oil refinery, capacity 2,500 bbl. per day.

Ont., Arnprior—Campbells Planing Mill, Ltd., Madawarka St., A. Campbell, Purch. Agt.—ripping and planing equipment for sash and door factory, etc.

Ont., Carleton Place—Bates & Innes, Ltd., C. Bates, Purch. Agt.—additional equipment for knitting mills.

Ont., Chesley—Chesley Chair Co., Ltd.—machinery for the manufacture of chairs.

Ont., Collingwood—R. Dodds, c/o Dodds Iron Wks.—special machinery and equipment for plant for the manufacture of flour mill equipment.

Ont., Cornwall — Howard Smith Paper Mills, Ltd., C. H. Smith, Pres.—machinery for addition to plant.

Ont., Eganville—Eganville Planing Mill, Ltd., G. R. Reinke, Purch. Agt.—additional equipment.

Ont., Gogama—Charette & Sons—equipment for sawmill, including steam driven bandsaw, to replace that which was destroyed by fire.

Ont., Oshawa—Gale & Trick, Athol St.—equipment, including saws, planers, buzz planers and shapers, for planing and woodworking mill, to replace that which was destroyed by fire. Cost between $5,000 and $8,000.

Ont., Toronto — Harper & Sons, 152 Franklin St.—saws, planers, motors, sash and door equipment for proposed wood products factory at Cooksville.

Que., Laprairie—W. Paquette, 30 St. Ignace St.—equipment for small foundry.

Que., Montreal—Canadian Wire Bound Boxes, Ltd., 17 Mill St.—equipment for the manufacture of boxes and packing cases.

Que., Montreal—F. Thomson Co., Ltd., 9 Ste. Genevieve St. (electrical engineer)—additional equipment for electric motor and dynamo repairs.

Que., Montreal—G. and J. Weir of Canada, Ltd., 179 Delormier Ave.—additional equipment for foundry at Lasalle.

Que., Montreal—Westmount Contg. Co., Ltd., 344 Mountain St.—8 x 8 in. belt driven air compressor.

Que., Pointe aux Trembles—A. Gelinas, 16th Ave.—sash and door manufacturing equipment, to replace that which was destroyed by fire.

Que., Rock Forest—T. Roy—equipment for small sawmill.

Que., St. Cesaire—J. Ducharme, St. Paul St.—additional machinery for sawmill.

Metal Working Shops

Calif., Oakland—The California Transit Co., et al., 55 5th St., San Francisco, plans to build a motor truck and bus factory, here. Estimated cost $500,000. Engineer or architect not selected.

Calif., Redwood City—The Gogle Hand-Forged Tool Co., 1914 Polk St., San Francisco, is having plans prepared for the construction of a factory, here. Cost will exceed $10,000. Mitchell-Jackson, Inc., 170 2nd Ave., San Mateo, Archts.

Calif., San Diego—The Motor Transit Co., 860 1st St., will build a 1 story, 100 x 200 ft. auto stage depot on 2nd and E Sts. Cost will exceed $75,000.

Calif., San Francisco—J. Allec, 2140 Folsom St., awarded the contract for the construction of a 1 story shop on Folsom and 17th Sts. Estimated cost $70,000. E. R. Bacon Co., 51 Minna St., dealer in contractors' equipment, lessee. Noted June 7.

Calif., San Francisco—The Hollingshead Co., 445 2nd St., manufacturer of automobile products, awarded the contract for the construction of a warehouse and factory on 17th and Connecticut Sts. Estimated cost $60,000.

Calif., San Rafael—The Eng. Dept. of the Pacific Gas and Electric Co., 445 Sutter St., San Francisco, is receiving bids for the construction of a warehouse, garage, meter and paint shops, etc., here. Estimated cost $40,000. Private plans. Noted May 17.

Conn., East Hartford (Hartford, P. O.)—The Mutual Gas & Oil Co., 371 Windsor St., Hartford, plans to build a 3 story garage and storage building on Folland St., here. Estimated cost $60,000. Estimated cost $60,000. Engineer or architect not selected.

Conn., Hartford—The H. P. Townsend Mfg. Co., 5 Chestnut St., manufacturer of special machinery, awarded the contract for the construction of a 2 story, 60 x 80 ft. factory on Walnut St. Estimated cost $65,000.

Conn., New Haven—The A. B. Hendryx Co., 86 Audubon St., manufacturer of bird cages, is having plans prepared for the construction of a 4 story, 45 x 50 ft. factory. Estimated cost $75,000. C. S. Palmer, 114 Whitney Ave., New Haven, Archt.

Conn., New Haven—C. Roessler, 60 Pearl St., is having plans prepared for the construction of a 1 and 2 story, 20 x 60 ft. and 30 x 80 ft. garage and factory for the manufacture of bologna on State St. Estimated cost $60,000. R. W. Fabian, 147 Bradley St., New Haven, Archt.

Conn., Stamford—J. and S. Gruber, 345 Summer St., will soon award the contract for the construction of a 2 story, 80 x 90 ft. garage on Beckley Ave. Estimated cost $55,000. Emmens & Abbott, Washington Bldg., Stamford, Archts. Noted May 31.

Ill., Chicago—N. T. Brenner, 954 West 21st St., awarded the contract for the construction of a 1 story, 102 x 300 ft. factory for the manufacture of copper rods and wire, at 3436-52 South Kedzie Ave. Estimated cost $300,000. Noted May 17.

Ill., Chicago—The Curtis Ledger Fixtures Co., 1115 West Jackson Blvd., manufacturer of display fixtures, awarded the contract for the construction of a 6 story, 56 x 178 ft. factory at 1119-1129 West Jackson Blvd. Estimated cost $225,000.

Ill., Chicago—The W. A. Jones Fdry. & Machine Co., 440 West Roosevelt Rd., awarded the contract for the construction of a 1 story factory at 4415-27 West Roosevelt Rd. Estimated cost $50,000.

Ill., Chicago—The Link Belt Co., Stewart Ave. and Pershing Rd., awarded the contract for the construction of a 1 story, 41 x 70 ft. and 22 x 170 ft. factory and machine shop at 327-339 West Pershing Rd. Estimated cost $150,000.

Ill., Chicago—W. C. Presto, Archt., 111 West Washington St., is receiving bids for the construction of a 1 story, 175 x 200 ft. automobile sales and service station on Lawrence Ave. near Whipple St. for A. D. Schuller, c/o Architect. Estimated cost $75,000.

Ill., Chicago—B. S. Schwartz, c/o D. S. Klafter, Archt., 64 West Randolph St., awarded the contract for the construction of a 1 story, 125 x 150 ft. garage on Lawrence St. near Kentucky St. Estimated cost $50,000. Noted Jan. 11.

Ill., Chicago—F. W. Steiner, 3348 Southport St., awarded the contract for the construction of a 1 story, 49 x 51 ft. machine shop at 3015-19 Ravenswood Ave. Estimated cost $15,000.

Ill., Freeport—The Arcade Mfg. Co., 1 Columbus Ave., will build a 3 story, 66 x 196 ft. addition to its factory for the manufacture of hardware and toys. Estimated cost $100,000.

Ill., Granite City — The Commonwealth Steel Co. is building a 1 to 3 story steel plant, including pattern shop, power house, 100 x 400 ft. foundry, 100 x 450 ft. core room with additional crane and 14 ovens, etc. Noted May 31.

Ind., South Bend—The Studebaker Corp., Main and Bronson Sts., awarded the contract for the construction of a 1 story, 660 x 683 ft. foundry on Prairie Ave. Noted May 17.

Ky., Louisville—The Summers Hermann Co., 905-11 South 3rd St., is having plans prepared for the construction of a 2 story, 95 x 100 ft. garage and sales building on 3rd and Breckinridge Sts. Estimated cost $75,000. Noted Jan. 25.

Md., Baltimore—H. Gamse & Bro., 419 East Lombard St., will soon award the contract for the construction of a 1 story, 45 x 100 ft. garage and storehouse at 423 East Lombard St. Estimated cost $40,000. E. H. C. Browne, Equitable Bldg., Baltimore, Archt.

Mass., Boston—The Gillette Safety Razor Co., 41 West 1st St., awarded the contract for the construction of an 8 story, 75 x 100 ft. factory. Estimated cost $400,000.

Mich., Detroit—The Book Estate, Book Bldg., is having plans prepared for the construction of a 20 story, 100 x 175 ft. garage on Washington Blvd. Estimated cost $450,000. L. Kamper, Kamper Bldg., Cass Ave., Detroit, Archt.

Mich., River Rouge (Detroit P. O.)—The Ford Motor Co., Highland Park, is having plans prepared for the construction of a 1 story, 94 x 1,320 ft. steel mill with 100 x 620 ft. and two 100 x 420 ft. sections; also a 1 story, 56 x 775 ft. monitor, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Minn., Minneapolis—P. E. Crosier, Archt., 915 New York Life Bldg., is receiving bids for the construction of a 1 story, 150 x 150 ft. garage on Aldrich Ave. N. and Bway. Estimated cost $65,000. W. H. Kuhlman Co., 605 West Bway., lessee.

Minn., Minneapolis—L. Kinsell, 409 East 18th St., is having plans prepared for the construction of a 2 story, 132 x 157 ft. garage on 5th Ave., South, and 3rd St. Estimated cost $125,000. Ekman, Holm & Co., 302 Phoenix Bldg., Minneapolis, Archts.

Minn., Moorhead—C. Schill is having plans prepared for the construction of a 2 story, 50 x 140 ft. garage. Estimated cost $45,000. J. E. Rosatti, 117 Bway, Fargo, N. D., Archt.

Mo., St. Louis—The Warren Steel Casting Co., 3400 Maury Ave., plans to build a 1 story, 100 x 200 ft. steel plant, to replace the one which was recently destroyed by fire. Estimated cost $75,000. Engineer or architect not announced.

N. Y., Brooklyn—S. Ageloff, 26 Court St., will build a garage on Chauncy St. Estimated cost $50,000.

N. Y., Brooklyn—J. J. Frill, 1473 Bway., is having plans prepared for the construction of a 1 story, 130 x 175 ft. garage on Troy Ave. Estimated cost $75,000. M. Klein, 37 Graham Ave., Brooklyn, Engr. and Archt.

N. Y., Brooklyn—L. Girshkowitz, c/o E. M. Adelsohn, Engr. and Archt., 1778 Pitkin Ave., will build a 1 story garage on Hudson St. Estimated cost $30,000.

N. Y., Brooklyn—The Terahin Realty Corp., c/o E. M. Adelsohn, Engr. and Archt., 1778 Pitkin Ave., will build a garage on 10th St. Estimated cost $50,000.

N. Y., New York—S. Rubin, c/o C. Schaefer, Engr. and Archt., 3946 East 150th St., will build a 1 story, 50 x 100 ft. garage on 157th St. near Courtland Ave. Estimated cost $25,000.

N. Y., New York—J. Tully, c/o Margon & Glaser, Engrs. and Archts., 2804 3rd Ave., will build a 1 story, 75 x 100 ft. garage on East 146th St. Estimated cost $35,000.

N. Y., Syracuse—The Adams Axle Co., North Franklin St., plans to build an addition to its plant. Estimated cost $5,000.

O., Cleveland—The Cleveland Piston & Mfg. Co., 1388 West 70th St., awarded the contract for the construction of a 1 story, 60 x 100 ft. factory on Scranton Rd. Estimated cost $40,000. J. H. Cox, Treas.

O., Cleveland—J. Parrish, c/o Dickman-De Groot Co., Williamson Bldg., is having plans prepared for the construction of a 1 story automobile show room and garage on a 35 x 192 ft. site at 7310 Carnegie Ave. Estimated cost $50,000. N. Petti, Williamson Bldg., Cleveland, Archt.

O., Cleveland—The Superior-Forty-Ninth Co., c/o G. Paul, Fidelity Mortgage Bldg., awarded the contract for the construction of a 1 story, 182 x 218 ft. garage at 5001 Superior Ave. Estimated cost $100,000. Noted Apr. 5.

Okla., Guthrie—The Atchison, Topeka & Santa Fe Ry. Co., 179 West Jackson St., Chicago, will soon receive bids for the construction of a 1 story, 50 x 200 ft. machine shop here. H. W. Wagner, 9th and Jackson Sts., Topeka, Kan., Ch. Engr. of Eastern Lines.

Okla., Tulsa—J. Thomas, 118 East 1st St., awarded the contract for the construction of a 1 story, 100 x 140 ft. garage. Estimated cost $40,000.

Pa., Latrobe—The Ry. Steel Spring Co., 30 Church St., New York City, awarded the contract for the construction of a 1 story, 178 x 1,000 ft. machine shop manufacturing and office building here. Estimated cost $350,000. Noted May 24.

Pa., Uniontown—The Rankin Motor Co., c/o H. W. Altman, Archt., Fayette Title & Trust Bldg., will build a 2 story, 52 x 102 ft. garage on Main St. Estimated cost $40,000.

Tex., Childress—The Fort Worth & Denver City R. R., Record Bldg., Fort Worth, is having plans prepared and will soon receive bids for the construction of paint and machine shops, to replace the ones which were recently destroyed by fire, here. Cost between $50,000 and $75,000. M. A. Stainer, Ch. Engr.

Wash., Seattle—The Pacific Telephone & Telegraph Co., Stuart Bldg., awarded the contract for the construction of a 2 story, 129 x 163 ft. addition to its garage and repair building at 806 Fairview Ave. Estimated cost $160,000.

Wis., Green Bay—The A. Libert Machine Co., 324 North Roosevelt St., awarded the contract for the construction of a 1 story, 55 x 100 ft. machine shop. Estimated cost $40,000. Noted May 3.

Wis., Port Washington—Schmidt Bros. are receiving bids for the construction of a 1 story, 52 x 100 ft. addition to garage. Estimated cost $40,000. F. Graf, 307 Grand Ave., Milwaukee, Archt. Noted May 31.

Wis., Strum—J. Malone is having plans prepared for the construction of a 1 story, 50 x 70 ft. garage and repair shop. Estimated cost $40,000. Private plans.

Que., Montreal—The Harbor Comrs. of Montreal are having plans prepared for the construction of a 3 story, 50 x 50 ft. machine and blacksmith shop on the Harbor Front. M. P. Brennell, Genl. Mgr. J. W. Harris, Harbor Comrs. Office, Engr.

This is NOT the end—

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American Machinist
Volume 58 NEW YORK, JUNE 21, 1923 Number 25

Repairing Locomotives in a Machine-Tool Shop

SPECIAL CORRESPONDENCE

The first of three articles—Shop located on main line — Cranes and other handling equipment — All classes of locomotive repairs handled

DURING THE PERIOD of business depression and uncertainty, two years ago, many machine-tool shops, both large and small, turned their attention to work outside their normal lines for the purpose of keeping their plants open and their workmen employed to the fullest possible extent until such time as the machine-tool market had reached something like a settled and dependable condition.

One such shop, fortunate in location as well as in the nature of its regular product, did not have far to seek for a line of business to which its equipment was adapted, in which a part of its executive force and some at least of its workmen were already trained and that did not involve vexatious new problems in the way of transportation of raw material, marketing, and delivery. The plant was already equipped with traveling cranes and other apparatus for handling heavy machine parts, the main floor was of concrete and provided with numerous pits over which the heavier machine tools of the shop's regular product had been erected, and spur tracks from a main line of railroad beside which the plant was situated already extended into the yards and shops. Therefore it was but logical that when such a plant was running at but a small part of its normal capacity, the management should turn its attention to an almost unlimited business waiting just outside its doors.

FIG. 1—THE LOCOMOTIVE BAY

In addition to these easily adaptable physical facilities, the company was fortunate in having as its works manager a man with years of experience in the motive power department of railroads, while some of his assistants were similarly qualified and not a few of the men in the shop had been recruited from railroad work.

The main building is of brick and steel construction and consists of two parallel bays joined throughout their length by single-story center section with saw tooth roof. A two-story extension, also running the full length of the building, adjoins one of the bays, and this extension, open toward the bay, has a gallery that provides floor space for the smaller machines as well as for tool and stock rooms. The sides of the building are mainly of glass and steel and the bays are covered with monitor roofs which, with the saw tooth roof, insure ample light to all parts of the floor. Each bay is served by two traveling cranes and jib cranes are swung at intervals from the supporting columns. Hand cranes, and hand and electric hoists serve the central and side sections.

One of the bays was used principally as an erecting shop for the larger machines of the regular product, and when the company decided to take on the overhauling of locomotives in addition to the regular business, one bay and a part of the central section were cleared, the spur tracks rearranged and additional tracks laid to cover

the pits left by the removal of the machinery. As all the large tools on the erecting floor were driven by independent motors, the conduits for electric cables were already laid and there were no "overhead works" to come down. Thus the machine building plant became a loco-

FIG. 2—90-IN. WHEEL LATHE

motive repair-shop almost overnight, with little or no expensive additions or alterations.

The company employs about 350 men on locomotive work and is repairing an average of eighteen locomotives of all classes per month, ranging from small yard engines to 200-ton freight locomotives of the Santa Fé type. The amount of repairs required upon the different engines varies to a considerable extent, but engines are not sent to this shop for minor repairs, so that each job amounts to something like a complete overhaul and in some cases to a practical rebuilding.

Locomotives to be repaired are delivered to the shop by the yard engine and are immediately taken in hand by a gang of checkers who are competent to determine what is necessary in the way of repairs, and the report of these men is compared with the railroad's repair order accompanying the engine. The engine is then dismantled of its minor parts, each part having painted upon it the number of the engine and, when necessary, a symbol denoting on which side it belongs.

Separate departments are established elsewhere in

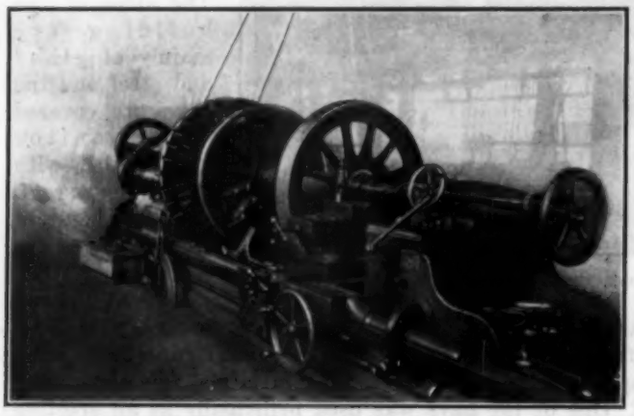

FIG. 3—TRAILER WHEELS IN ENGINE LATHE

the shop for the repair of rods, valves, motion-work, etc., and each part after being cleaned from oil and grease is dispatched to its respective department for further inspection. The engine itself is then lifted from its driving wheels by two cranes and deposited upon timber blocking at some convenient part of the main floor, leaving the track free for the reception of the next engine to be delivered.

As soon as they are cleaned, the frames, rods and other parts susceptible to hidden cracks are painted with a solution of whiting and alcohol which dries very quickly, and are allowed to stand for several hours. The exudation of oil from an otherwise undiscernible crack will soon discolor the white surface.

In Fig. 1 is a veiw of the locomotive floor, the photograph being taken from the cab of one of the traveling cranes.

In dismounting or wheeling a locomotive, two cranes are used. A wire cable is wrapped once around the smoke box and the loops at the ends of the cable attached to the crane hooks. The rear end is handled in a special sling composed of two pairs of I-beams joined

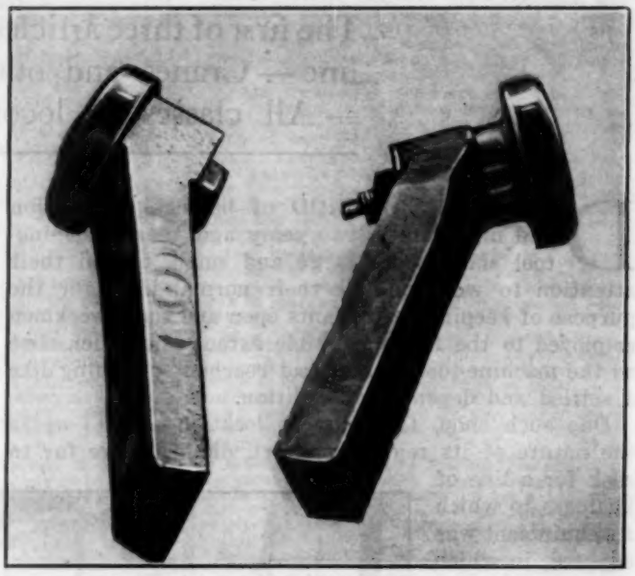

FIG. 4—TOOLS FOR ROLLING JOURNALS

together at the outer ends by wire cables. The rear ends of the locomotive frames rest upon the lower beam, and the crane hook is attached to an eye-bolt in the upper beam. No difficulty is experienced in handling the heavy weight with the two cranes, though close team work on the part of the operators is essential.

There is but one permanently located machine upon the main floor and that is the 90-in. driving-wheel lathe shown in Fig. 2. Though trailer and truck wheels are handled upon smaller wheel lathes in other parts of the shop and even upon regular engine lathes, all wheels over 54 in. in diameter come to this machine and it is in operation night and day.

Turning Driving Wheels

The tire setters have a space on the main floor adjacent to the wheel lathe and as each pair of wheels is inspected it is delivered here to have the treads returned or new tires set as may be necessary. That pair of drivers out of a set or two, three, four or five pairs that shows the greatest wear upon any given engine is given first attention. If the condition of this pair of tires will permit re-turning without reducing them below a minimum limit of thickness they are turned off just enough to true them up and fit them to the contour gage. The tires of the remaining drivers of the same engine must then be turned to the same diameter as the

first pair, regardless of the amount of metal removed, for it is very necessary that all drivers of a set should be of the same diameter.

The rough turning is done with round nose tools of Rex AA-steel, ground by hand in accordance with the judgment of the operator. The finishing chip is taken with two forming tools of the same material, one tool forming the flange and a portion of the tread while the remainder of the tread is taken care of by the other tool. These latter tools are re-ground upon the surface grinding machine in the tool room.

Trailer and truck wheels are handled upon smaller lathes in other parts of the shop. A pair of trailer wheels is shown in Fig. 3, mounted in a 60-in. engine lathe for facing the hubs and re-turning journals. Grinding is not resorted to in any of the operations on wheels or axles. Journals are turned off sufficiently to make them true and the surface is then smoothed by rolling. A pair of rolling tools is shown in Fig. 4, one of which is used upon journals and the other upon the faces of wheel hubs.

Welding plays an important part in railroad repair-work, and this shop not only has a welding department for such of the smaller parts as can be transported easily, but is fully equipped with portable outfits, both gas and electric, for the jobs that require the welding to be done in place. In wheel work, welding is employed to repair cracked or broken spokes, and sometimes to build up wheel centers that have become worn because of loose tires.

In Fig. 5 is shown a pair of wheel centers being built up by the arc welding process, and in Fig. 6 is shown a "close-up" of the periphery at the point where the build-

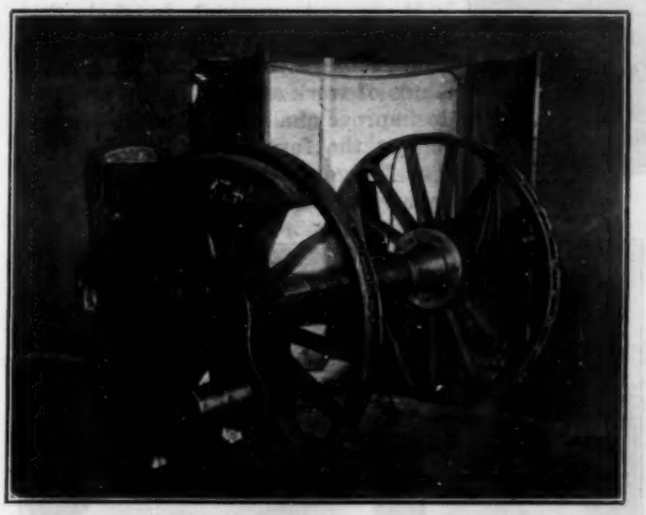

FIG. 5—BUILDING UP WHEEL-CENTERS BY WELDING

ing up was started. The material used for this purpose is Norway iron in the form of a special welding rod. About ¼ in. is being added to the radius of the wheel, but this amount will be considerably reduced in the subsequent turning operation. In Fig. 5 the actual welding is in progress, as may be seen from the intense light from the arc upon the protective screen. The portable generator set may be seen in the same figure, just beyond the nearer wheel.

The amount of repairs permitted upon a driving-wheel center by welding has an arbitrary limitation. If a rim or more than three spokes are broken the wheel is scrapped and a new one substituted for it.

Crankpins, if not too badly worn, may be restored to usefulness by re-turning them, the work being done with a portable machine applied to a driving wheel wherever it may be, whether in place on the engine or elsewhere, but ordinarily the crankpin turner remains in his allotted space and the work is brought to him by

FIG. 6—THE BEGINNING OF THE WELD

the crane, as it is easier to move a pair of wheels than the turning outfit.

The crankpin turning-machine is shown in Fig. 7, attached to a driving wheel and ready to start the operation of turning. The inner end of the base is machined square with the ways and bears upon a pair of parallels against the hub of the driving wheel, to which it is held by straps and bolts. The wooden blocking to be seen in the figure is for convenience in setting the device.

After mounting the machine in approximate position but before finally tightening the bolts that hold it, the center-pointed screw *A* is advanced to meet the original center in the crankpin. With a lead mallet the operator taps the base of the machine to drive it in one direction or another until the center-point enters the center in the

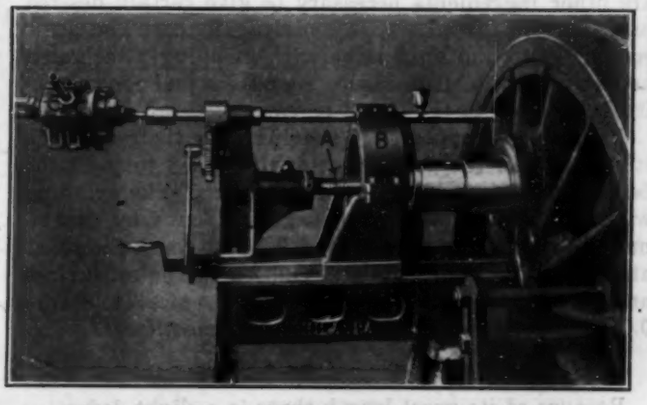

FIG. 7—THE CRANKPIN TURNING-MACHINE

pin exactly. The holding bolts are then finally tightened. A ring revolves in the housing *B*, driven by the air-motor *C* upon the end of the pinion shaft. Upon the inner surface of this ring is provision for holding three turning tools, each adjustable radially by means of setscrews.

The housing *B* slides upon the ways in a direction parallel to the axis of the work and is actuated by a screw equipped with a ratchet and pawl feed. For roughing cuts, if much material is to be removed, all three tools may be used, but for finishing cuts, only one tool is left in action in order to secure roundness of the pin and smoothness of its surface.

When the first pin is finished the clamping bolts are released and the pair of drivers is picked up by the crane and its position reversed, this movement requiring but a minute or two, whereas to carry the turning outfit around to the wheel on the other side would take much longer. Besides the blocking for supporting the device would have to be moved and reset.

Grinding Printers' Rollers

BY B. W. LEWIS

THAT the process of grinding has penetrated industries other than those confined to the making of metals is shown by the accompanying illustration, taken at the plant of the Ideal Roller and Manufacturing Co.,

FIG. 1—GRINDING THE IDEAL ROLLER

Incorporated, 49th St. and First Ave., Brooklyn, N. Y.

The Ideal roller is composed, for the most part, of linseed oil vulcanized with sulphur chloride, although there are other ingredients necessary to give certain desired properties to the oil. It is centrifugally cast and after cooling is ground on a lathe with grinding attachment as shown in Fig. 1, to insure roundness and concentricity in relation to the shaft, or core.

The roller is supported in bearings, like those in which it will run on the press, that are fastened to the lathe bed, and is driven by face plate and dog. The grinding wheel, of special material and grade, found by experiment to be best for the purpose, is set to touch the roller at the top. A roughing cut removes the outer surface and a finishing cut reduces the roller to size (tolerance 0.002 in.) and produces the required smoothness.

SLIGHT OVERSIZE AT CENTER DESIRABLE

Because of its great length there is a slight deflection in the roller while it is on the lathe, causing it to be ground somewhat larger in the middle. Such oversize in the middle is desirable because when on the press the roller is subject to a bending force that tends to bow it away from the form at the center. Without uniform pressure on the form the printed page will be streaked.

The smooth surface given by the grinding wheel is not the best surface for all kinds of work. A finish called "grained surface" is given to many rollers. The operation of graining is performed as shown in Fig. 2, using a comb-like knife of tool steel.

Casting is done on a lathe specially arranged for the purpose. The outer shell made of vulcanized linseed oil is cast in a rotating steel mold which has been previously lined with wax. After the vulcanization of the outer layer, the mold, with the shell adhering to its inner surface is set up on a stand with a special centering bushing at the base end. The inner core, which consists of vulcanized soya bean oil, is then poured around the stock. After the air has risen to the top, a centering bushing is applied to hold the top of the stock in the center of the mold. When the core has become solid (requiring usually about 25 min.) the mold is heated with a gas flame, the wax runs out and the mold is drawn from the roller. The roller is then trimmed at the ends, protecting washers are applied and it is ready for the grinding operation.

It is not unusual to find that methods originated for metal working operations are being adapted to other kinds of work and the use of grinding to improve quality and reduce costs is among the foremost in that respect. The foregoing example is only one of many where soft materials are ground.

FIG. 2—GRAINING THE ROLLER

Industrial Cost Accounting for Executives

By PAUL M. ATKINS

Article fourteen deals with manufacturing expenses—Classification of maintenance—Recording wages and salaries—Analysis of retainer and reclamation of errors accounts

IN THE preceding article we discussed the question of fixed charges and we saw that because of their very fixity they presented certain important problems to the manager. A part of the other principal group of expenses will be considered here, those which are variable, and we find that they, too, have considerable significance to the executive. In the case of the fixed charges, the interest lay in the fact that they were invariable and that it was necessary to meet them in dull as well as busy seasons. Because of their very fixity, however, they yield no information as to the conduct of the business, while it is just in this respect that the variable expenses are a means of control in the hands of the able manager. One of the best ways in which the executive can inform himself in regard to what is going on in the business is by a study of certain variable expense accounts.

Maintenance Accounts

One of the most important classes of expense accounts for the manufacturing departments in general consists of those in which the costs of maintenance and repair of the building and equipment including furniture and fixtures, machinery and tools, are recorded. It will be remembered that in the article discussing the classification of expenses the accounts were shown in considerable detail for the department chosen as an illustration—the machine shop. Experience has pretty well established the desirability of such a course, for they are records in which large values may be lost track of if not arranged to provide for comparison and study.

There are several ways in which it is convenient to classify maintenance. One way is indicated in the expense classification where the work and the resulting records are first grouped according to departments, and then according to the kind of equipment which is the subject of the repair. From the point of view of the actual control of the operations, another analysis is often helpful, one that does not in any way interfere with the keeping of the records in the form described previously. There are some repairs which come at regular and rather long intervals such as the general overhauling of machines and the periodic renovation of the building. That is maintenance work which can be planned for relatively long periods ahead of the date set for its accomplishment. In short, it can be scheduled in much the same way as the regular production can be scheduled.

The authority for the actual performance of this work is usually transmitted, first from the factory manager to the plant engineer in the form of instructions to take charge of his department as defined in the organization manual and to perform such specific duties as may be incorporated in his standard practice instructions, one of which, of course, would be to see that the periodic overhauling is performed. He would issue his orders for the specific performance of the work in the shape of what is often called a work order, an illustration of which is shown in Fig. 41. The maintenance workers should receive from their foreman on the strength of this order, time tickets that would serve both as instructions to them and as a means of recording their time spent on the job.

The second class of maintenance tasks includes those which are also regular but which come at frequent intervals, every day, every week, or at least as often as once a month. The sweeping of the floors, the cleaning and oiling of the machinery, the removal of chips, and various other tasks of that kind, which may be characterized as factory housekeeping, fall in this group. Such work can also be planned, scheduled and

WORK ORDER **H**

DESCRIPTION OF WORK TO BE PERFORMED	RECORD OF COST			
		ESTIMATED		ACTUAL
	Material			
	Labor			
	Burden			
	Total			

Cost Estimated by

Actual Cost Noted by FM

Cost Posted to AC Records

NOTE—Burden will be charged only on orders chargeable to asset accounts and other number accounts.

Date written Written by Charge to OK—FM To be performed by

Date set for completion Date started Date completed By

DIRECTIONS:—Send all three copies to FM for approval and number. Blue copy will then be sent to AC and other two to AP. AP will send original to department to perform the work. Upon completion of the work, this department will return original to AP, showing dates started and completed and AP will forward same to AC. Estimated cost must be entered on each order.

FIG. 41—WORK ORDER *Courtesy of the Square D Co.*

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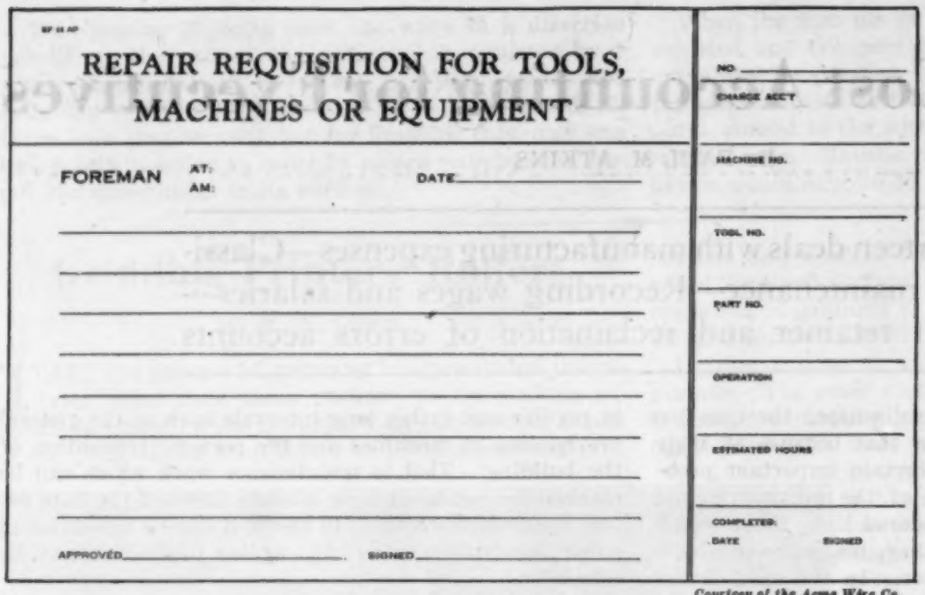


REPAIR REQUISITION FOR TOOLS, MACHINES OR EQUIPMENT

FOREMAN AT: AM: DATE

APPROVED SIGNED

NO.
CHARGE ACCT
MACHINE NO.
TOOL NO.
PART NO.
OPERATION
ESTIMATED HOURS
COMPLETED: DATE SIGNED

FIG. 42—SPECIAL REPAIR ORDER

Courtesy of the Acme Wire Co.

dispatched in considerable detail though often quite informally. It is usually authorized by means of standing orders to those who are responsible for the work, such as the department foremen and head janitor.

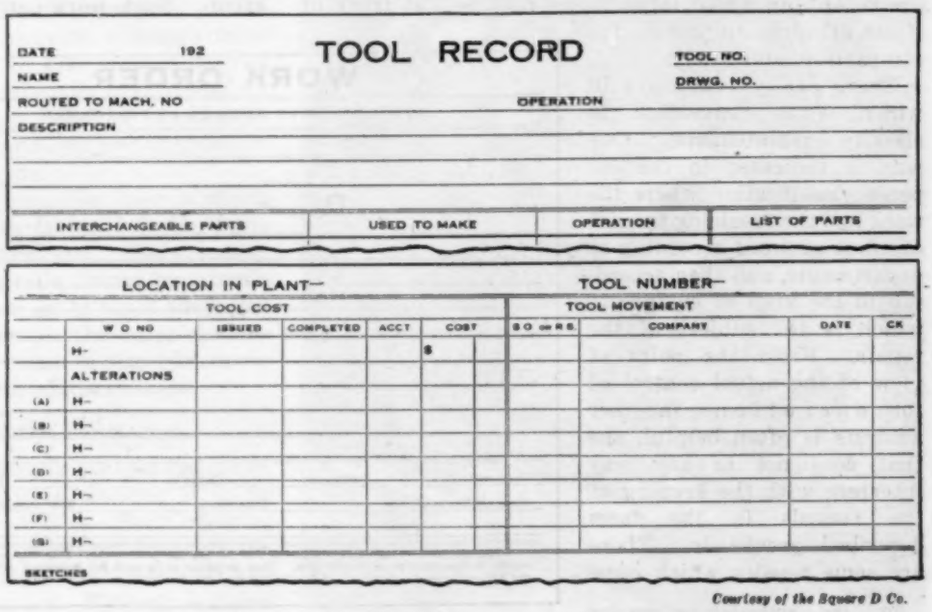
The third group comprises the occasional breakdowns that will take place in spite of the most careful anticipation of any trouble. They are unforeseen, and naturally cannot be scheduled, though it is often quite essential that they be dispatched without delay when they do occur. They are usually authorized by means of a special repair order such as is illustrated in Fig. 42, or by a work order like that shown in the preceding figure.

It is essential to note that for all the orders, including the standing order, directions are given as to what expense account is to be charged with the costs which result from the performance of the task. The expense account symbol should be placed on every time ticket, material issue or any other paper which is used in connection with the order so that every element of cost may be correctly charged. In the case of work orders, it is essential also that their number be shown in addition to the expense symbol for it is often important to know how much the individual order has cost. This is particularly true for equipment because the record thus made is entered on the form shown in Fig. 38 in the preceding article (equipment record) and is of very great assistance in the scheduling of expenses and the makeup of earned burden rates.

One of the maintenance accounts — that for tools — needs consideration from another point of view. It will be remembered that in the preceding article the statement was made that often no reserve for depreciation account was maintained for tools. The reason is that many tools are used up with such rapidity that the rate of depreciation would be two or three hundred per cent a year and the tool-keeping necessary to maintain records under such conditions would cost far more than any offsetting gain. A similar method, and one that has worked satisfactorily under a wide variety of conditions, is to charge to the inventory account for tools only one-half the value of all new tools except for those which are used to replace worn out tools. The other half of the value in the care of new acquisitions and the entire cost for renewals should be charged to the tool maintenance account of the department in which the tools are to be used. Of course, as long as purchased tools remain in their original packages in the stores department they should be carried at cost value in the stores account and the entries made at the time they are issued for use.

Conditions Regarding the Tool Account

The reasoning back of the arrangement is as follows: For a going business the average condition of the tools is about one-half worn out. Therefore, one-half cost value represents a fair inventory value at any particular time. Replacements then, simply represent the cost of maintaining the tool inventory in a normal condition. At the time additional tools are acquired, it means that for a while the tool inventory is somewhat undervalued but the variation is so small as to be of no importance and may properly be neglected, for the method greatly simplifies the cost records and is accurate enough for all practical purposes. A very help-



TOOL RECORD

DATE 192 NAME TOOL NO. DRWG. NO.
ROUTED TO MACH. NO OPERATION
DESCRIPTION

INTERCHANGEABLE PARTS	USED TO MAKE	OPERATION	LIST OF PARTS

LOCATION IN PLANT— TOOL NUMBER—

	TOOL COST						TOOL MOVEMENT			
	W O NO	ISSUED	COMPLETED	ACCT	COST		S O or R S	COMPANY	DATE	CK
	H—				$					
	ALTERATIONS									
(A)	H—									
(B)	H—									
(C)	H—									
(D)	H—									
(E)	H—									
(F)	H—									
(G)	H—									

SKETCHES

Courtesy of the Square D Co.

FIG. 43—FRONT AND REAR SIDES OF TOOL RECORD CARD

ful form for a tool record which may be used in this connection is shown in Fig. 43. It differs materially from the form shown in Fig. 38 of the preceding article that was designed as a record for relatively permanent equipment. A set of cards like the one shown here should be prepared to support the tool account in the general ledger.

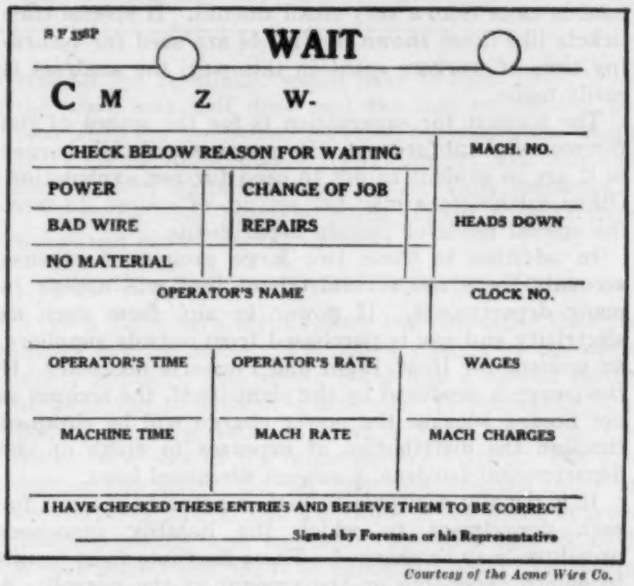
The dividing line between the various maintenance accounts is often rather hazy. The important thing in this connection is to have the line drawn clearly rather than balance with great nicety the border line cases. It must be borne in mind in setting up the accounts that there are factory needs as well as departmental needs and both must be considered in reaching a decision. It might very well be that for certain departments one expense account could very easily cover the field occupied by two in some other department, but still it would be unwise to combine the two in the department in question for it would preclude the possibility of securing totals of various classes of maintenance expenses. With the arrangement as outlined in the article on expense classification it would be very simple to find out the total spent for the maintenance of machinery, for example, by summing up the departmental expense accounts for the item. Of course, it is quite possible that a single department may have certain peculiar maintenance expenses—the repair of the cupola in a foundry, for instance—which should properly have a maintenance account to itself and essentially for the same reason, to keep the different classes of maintenance expenses segregated on the same basis.

The Wages and Salaries Accounts

The other important group of accounts which is usually found in the manufacturing departments is that in which the wages paid the indirect workers are recorded, and other wages which are allocatable in a satisfactory fashion elsewhere. In some few cases, a single account for a department may be sufficient but often a group of accounts is necessary. Subdivisions for inspectors, move-men, instructors, planning and dispatch clerks, retainers and supervision, to follow the classification suggested in Article XII of the series, are often found. Some of these accounts may appear unusual and a few words of explanation may be necessary.

Perhaps some of the readers may remember that in the article in which the functionalization and organization of a business was discussed the inspection department was placed directly under the factory manager. Yet, in the classification shown in the article dealing with expense classification, an account for inspectors' wages is shown for the machine shop department. The apparent divergence can be reconciled without any difficulty, however. Its place in the organization is properly that shown in the article dealing with that subject. The inspectors, no matter where their work may be, should be under the direction of a head inspector who should not come under the supervision of any one whose prime, not to say whose sole, interest lies in getting out production. In most factories, however, it will be found that the inspectors commonly test the output of a certain department and seldom change to that of another. Even though they do, there is seldom any question as to the department whose work they are inspecting. Under these conditions, it is quite easy to charge the time of the inspectors to an account of the department which is benefited by their services. The chief inspector's salary can be allocated on a pro rata basis, and in this way a whole set of departmental expense accounts may be eliminated since wages are almost the only cost of operating an inspection department. What few other expenses exist can be charged to the proper expense accounts of the department for which the inspectors are working. Another and more important advantage is that it eliminates an expense distribution and hence gives more accurate expense allocation.

Very much the same thing can be said in the case of move-men, except that in this case, it is not at all essential that they be organized in the form of a separate material transportation department. In most cases, the move-men work within a single department and inter-


S F 1917

WAIT

C M Z W.

CHECK BELOW REASON FOR WAITING				MACH. NO.
POWER		CHANGE OF JOB		
BAD WIRE		REPAIRS		HEADS DOWN
NO MATERIAL				
OPERATOR'S NAME				CLOCK NO.
OPERATOR'S TIME		OPERATOR'S RATE		WAGES
MACHINE TIME		MACH RATE		MACH CHARGES

I HAVE CHECKED THESE ENTRIES AND BELIEVE THEM TO BE CORRECT

Signed by Foreman or his Representative

Courtesy of the Acme Wire Co.

FIG. 44—WAIT TICKETS FOR RECORDING LOST TIME

departmental transportation can easily be provided for by directing that each department shall be responsible for the movement of materials from it to the place where they are going.

Instructors are in such cases really a part of the supervisory force and in most instances, form an important aid to that function. In some concerns, however, they are organized as a part of the training department and bear something like the same relationship to the departments in which they are actually located as do inspectors. If for these, or any other reasons, it is desired to keep a separate record of the cost of such service then it is desirable to have an account of this kind. It is particularly true when instructors are paid a bonus dependent on the efficiency of the instruction which they give.

Planning and dispatch clerks are really members of the planning department who are located in the several direct manufacturing departments to operate the dispatch wards and regulate the movement of the work through the departments. The purpose of a separate account for them is to eliminate the necessity of distributing that additional amount of the expense of the planning department. At the same time, it is quite essential that these wages be kept separate from the others, so that the total expense of the planning department may be ascertained at any time for control purposes.

Another account in the group is one called the retainer account and to it should be charged all the time of workers who are paid to remain on the premises of

the company, but who are not engaged in any task which renders a benefit to the concern. There are many occasions when such losses occur. Unanticipated machine breakdowns, trouble with materials, failure to deliver materials as directed, trouble with tools, etc., and other similar reasons will cause workers to remain idle through no fault of their own. It is only appropriate, of course, that they shall be paid, but it is equally appropriate that their time shall not be charged to any order or expense account which does not receive any benefit. The account is one of the most useful records for control purposes that is to be found. It is often desirable to have it carefully analyzed in case its total is more than a very small amount. If special time tickets like those shown in Fig. 44 are used for recording time of workers spent in this way, the analysis is easily made.

The account for supervision is for the wages of the foremen and subforemen. Its purpose and the charges to it are so evident as not to need further explanation. Other subdivisions may bet set up, of course, to meet the special needs of certain departments.

In addition to these two large groups of expense accounts there are several others that will appear in many departments. If power in any form such as electricity and gas is purchased from outside suppliers, an account for Heat, Light and Power is necessary. If the power is produced by the plant itself, the account is not needed because the power charge will be obtained through the distribution of expenses to make up the departmental burdens, a subject discussed later.

It is usually desirable to have a separate account for each department to which the liability insurance premiums may be charged. These fluctuate from month to month depending on the amount of the payroll. A miscellaneous expense account should be set up for each department to which the occasional item may be charged. Otherwise, it would be necessary to force the item into some other expense account and reduce its value very materially for purposes of comparison, and in that way limit its utility as a means of control.

The Reclamation of Errors Account

Two other accounts need brief mention before closing the discussion of manufacturing expenses. One is the reclamation of errors account that was briefly explained in the preceding article. It may appear at first glance as though there was some confusion between this account and the retainer account previously described. Charges to both accounts are made because of mistakes, for it is really only due to mistakes that men are ever allowed to remain idle. The retainers may be thought of, however, as the costs of errors of omission and of failures to think far enough ahead, while to the reclamation of errors account should be charged those errors of commission occurring when work has been done, but done badly.

The other account referred to is one for supplies. There is hardly a department that will not have need for such an account to which all kinds of materials used in the operation of the department and not properly chargeable to any other expense account of the department may be debited. In case materials going directly into the product, like nails, glue, paint and enamel are not charged to the orders on which they are used for one reason or another, but are charged to this account, it ought to be subdivided into two sections—one for the direct materials and the other for the ordinary supplies.

Corrections for Part Two of "Factors Governing the Strength of Gear Teeth"

In the article on "Factors Governing the Strength of Gear Teeth" by Douglas T. Hamilton, appearing on page 787, Vol. 58 of the *American Machinist*, two errors appeared which need correction in order to give a complete description of the matter under consideration.

The first error is on page 788, third line above Table IV. The figure number referred to in this line should

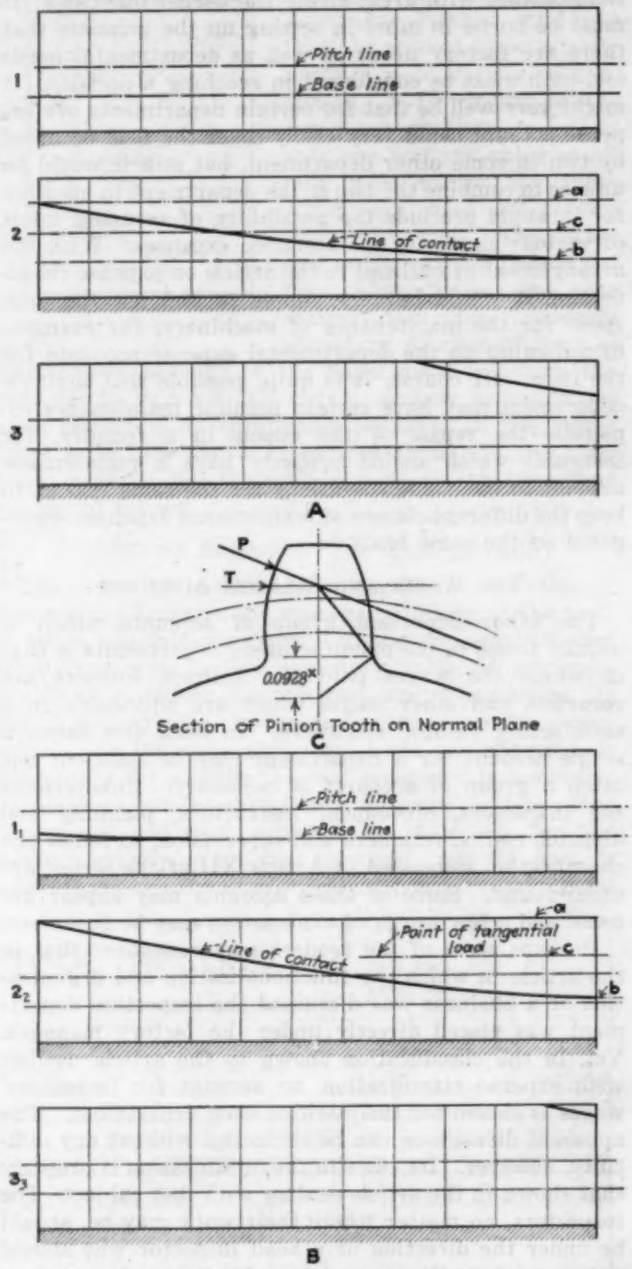


FIG. 7—"PATH OF CONTACT" OF HELICAL GEAR TEETH IN TWO POSITIONS; ALSO METHOD OF OBTAINING STRENGTH FACTOR

be Fig. 4 instead of Fig. 5. On page 790 the second error occurs. The cut on that page, indicated as Fig. 7, is part of Table IV appearing on page 788. Fig. 7 has been left out and is shown in the illustration herewith. This illustration graphically represents a diagrammatic method of determining the strength of helical gear teeth, and particularly the location of the point of the tooth through which the greatest load is taken.

Advance Payments on Special Machinery

BY JOHN R. GODFREY

Johnson refuses to buy built-to-order machines without paying part of the cost with order and the remainder as the work progresses, and gives the machine-tool salesman some advice along that line

JOHNSON has been throwing another bomb into the machine tool camp—but not at the builders so much as at the buyers. I guess it startled one side as much as the other. He wanted some special milling machines or rather special fixtures and attachments for standard machines, because he is strong on using standard stuff as far as possible. Only in this case the attachments, or fixtures, cost as much as the machines.

He'd already sprung the royalty proposition, as I told you some time ago, and says it's the only fair way to do. He's saving money every day and the machine builder gets a nice little check periodically on the savings made. Now he's carrying it a bit further.

Johnson and the milling machine man, who was one of the kind of dealers who really go after orders and don't wait for them to be handed up on a platter, had come to an agreement as to price, which was plenty but not unreasonable, all things considered.

"And now, Mr. Miller, what about terms? These machines run into a lot of money and are special. No use to anyone else. What about payments?"

"Oh, Mr. Johnson, don't talk about money. We know you are good as gold, we know you always pay promptly, and we'll take our chance on getting our money when we deliver the machines."

Getting Stuck with Special Machines

"Them is nice words, Mr. Miller," says the old man, "and I'm not so used to flattery that they don't sound good to my ears. But I happen to know that you said the same thing, or at least acted the same way, with the Acme Motor Co. and got stuck good and plenty. Now you want to play the same game with me and take a chance on my turning crooked, or getting hit by a trolley, or something else. You must be either a millionaire or an easy mark. In either case it's a rotten way to do business. What you machine tool men need is a backbone instead of a wishbone. Here you've made the automobile game possible and you haven't the nerve to profit by their example.

"You seem to have forgotten that when autos were new and not in such demand, they made you come across with a good, healthy deposit of cash—from a quarter to half the cost of the buzz wagon, with the order. They built the car with your money and didn't take any chances with cancellations if you happened to change your mind. Well, that's what you ought to do with all special machinery.

"If I built a special motor for any bird who wasn't satisfied with my regular product, he'd pay me twenty-five per cent with the order and another twenty-five per cent when the job actually started through the shop. Half of the remainder would have to come along when the work was half done and the last twenty-five per cent when the motor was delivered for shipment. Regular stuff is different—but you haven't any business fooling with specials unless you are fully protected."

"But the other builders might take it without those terms and you'd lose the order."

Rather Lose the Order Than the Money

"Son, I'd a durn sight rather lose the order than the money for the motor. I'll take a chance on the order but if any bird gets me to build him a special motor, he pays for it without a lawsuit. I'm ordering your milling machine because I want your kind. A few dollars one way or the other doesn't matter. It's production I'm after. I'd not only give you the order on the terms I named but I'd think a lot more of your business ability and backbone, if you'd said it first. A man hasn't any right to cancel an order for special machinery except under extraordinary circumstances, and then he should do his darndest to make good on the total cost to date of cancellation.

"But there's a lot of men who take a chance on ordering stuff, hoping they'll need it, and cancelling on the least provocation, leaving you to hold the bag. Don't let 'em get away with it any longer. Get some sand in your craw and demand partial payment with the order and the rest as the work goes on. You won't lose a thing by it and you'll save money in the long run."

It isn't often that a buyer gives the seller pointers or terms—but isn't Johnson right?

Steel for Brinell Balls

In measuring the hardness of metals by the Brinell method, a hardened steel ball is forced into the specimen by hydraulic pressure, the amount of penetration serving as an indication of the hardness of the sample. Difficulty has been found in measuring the Brinell hardness of steel having a hardness over 500 B.h.n.

An attempt has been made by the Bureau of Standards for the past three or four years to obtain a very hard steel which will carry the load of 3,000 kg. without fracture, but up to the present without success. Tungsten carbide has been suggested, but it has been impossible to obtain this material in suitable condition in either this country or Germany. Recently a very hard vanadium steel made at the bureau's laboratories has been tried and shows promise of success. More of it will be made, and if future experiments are successful, an important advance in the art of hardness testing may result.

Why Our Letters Produce More Profits

By Sherman Perry
Corresponding Advisor, The American Rolling Mill Co.

A LITTLE more than three years ago anyone looking over the everyday letters of the American Rolling Mill Co. would have found that they were very much like the letters of any other large firm. In diction, our letters were full of old, hackneyed, threadbare business phraseology, typical of the correspondent who feels that letter writing is no different from what it was centuries ago. It had never occurred to some of our correspondents that every letter should be a sales letter—forceful, logical, convincing. Even from a mechanical standpoint, there was no similarity. Each stenographer followed her own idea as to form and arrangement. In a word, three years ago, Armco letters did not have one single outstanding family characteristic.

The things for which we constantly strive now in Armco letters is to make every letter a sales letter, regardless of the department in which it is written. To get this idea across to our dictators and stenographers, we began by issuing a weekly letter bulletin. This bulletin is a single page 8½x11 in. In it we try to put some practical information on letter-writing as applied to our particular business. The bulletin is brief enough so that it can be read in about three minutes. It is then filed in a folder furnished by the correspondence department and kept for reference. In the 160 bulletins that we have put out, we have been able to cover in a most practical manner Armco problems of letter-writing. About 300 persons in our offices and operating departments read the letter bulletin regularly. If they miss a number, they will call up and ask for it. The folders of letter bulletins are their weekly lessons in letter-writing. They value these bulletins and keep them in their desks as a handy reference. Correspondents have frequently referred to the letter bulletins as the Armco letter-writing bible. In fact is was the practical information which this single sheet carried each week that completely sold our organization on the value of correspondence supervision.

Actual and Constant Supervision

After the bulletins had paved the way, we went to the correspondents and asked them for carbon copies of their letters. We told them that we wanted to look over these copies and to see if we could help them with the problems that actually came across the desk. The correspondent was only too glad to get this assistance. Copies of his letters now come regularly to the correspondence department where they are gone over carefully. Wordiness is cut down and the extermination is carried on against the old type of commercial phrasing, better known as commercial chestnuts. Frequently a letter is entirely re-written

Sales letters are gone over from the standpoint of salesmanship. It is our aim to have Armco sales letters carry specific, concrete facts, rather than generalities. We want our sales letters aimed at the need, benefit and profit of the reader. We want the reader to know the facts about our product. And if we do the job well, we tell the prospect something different from, and more valuable than, the things our competitors tell him.

After this inspection, the carbon copies are returned to the correspondent for his consideration. He uses his judgment and accepts that which seems good to him. Frequently the correspondent and the correspondence supervisor sit down and frankly discuss the particular problem and how best to solve it. In this way, each learns from the other, and the correspondence supervisor pools and passes out the information to the entire organization.

Carbon copies also reveal the defects of the transcriber. These mistakes are recorded on a slip of paper and sent to her. She is told definitely just what her mistake is and how to correct it. In fact everything that we do in the way of correspondence supervision tries to develop maximum teamwork between the dictator and the transcriber.

Better Letters at Less Cost

All this tends to cut cost and speed up production through the elimination of worn-out, meaningless expressions. We have cut down on many of our letters as much as 50 per cent in length. Through standardized letter form—that is following the definite plan of letter make-up—the transcriber turns out more letters. A time study showed that we save 50 hours on each 10,000 letters by writing the date in the upper right corner, by eliminating superfluous punctuation, and by using the block paragraph. At first our stenographers did not take kindly to the idea of standardizing the appearance of Armco letters. They could not see the value of it. But now they know that standardization makes the work of the transcriber as easy and simple as it is possible to make it.

Out of correspondence supervision has come out two booklets "The Mechanics of Correspondence" and "Principles of Good Correspondence." "The Mechanics of Correspondence" is a stenographer's manual. In it she finds the answers to the many problems that come up in her work: problems of punctuation, syllable division, word usage, abbreviations, the use of figures, capitalization, titles, directing mail, and the effective use of the typewriter. She also has a list of 800 words that are difficult to spell and a list of 1,200 words peculiar to our particular business. Each word is divided into syllables, the accents marked, and in addition she is given the correct shorthand outline. "The Mechanics of Correspondence" is brief and to the point. In 80 pages, 6x9 in., it gives, in the least possible space, the answers to our problems. The booklet is thoroughly indexed for reference.

"Principles of Good Correspondence" is a 64-page booklet, also 6x9 in. All the material has been gathered from our experience. The correspondent can read it in an evening, and he can read it with all the satisfaction that he is getting something that he can use on the job. It is his reference book on letter-writing. And whenever mistakes are found in any of his carbon copies, he gets a slip of paper referring him to a certain page of the "Principles of Good Correspondence" where he can find material that will help him. By this method of using the reference much time is saved.

The third unit of our booklets is in manuscript form. It is on business English, a subject vital to good correspondence. It will contain about 32 pages, 6x9 in. The material has been collected by reading 10,000 Armco letters. Both the correspondent and the transcriber can use it with an assurance that it contains the answers to almost any questions on business English that come up in our organization.

Paper presented at the National Conference of Business Editors at Middletown, Ohio.

Machining the Wright Aviation-Engine Cylinder Block

By FRED H. COLVIN
Editor, *American Machinist*

The first of a series of articles — Problems in boring and tapping the aluminum block for a long, threaded steel sleeve —Securing close contact for conducting heat of combustion

THE CYLINDERS of the Wright, Hispano-type aeronautical engine, are of such unusual construction that in order to appreciate the machining problems, it is necessary to thoroughly understand its construction. For that reason a view of the motor, Fig. 1, and the sectional view of a portion of the cylinder block, Fig. 8, with two of the cylinder sleeves in position are shown herewith. The completed block has four cylinders. The motor has two of these blocks set at an angle of 90 deg., making the well known 300-hp. eight-cylinder, V-type airplane-engine.

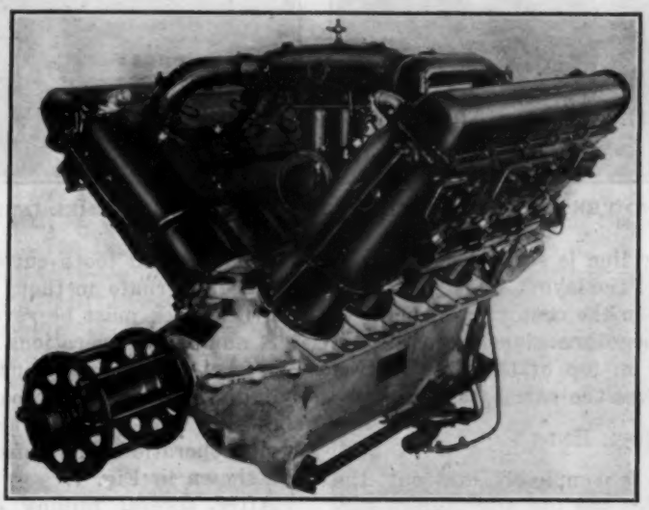


FIG. 1—COMPLETE MOTOR

Outline of Operations

Anneal casting
Layout for milling
Mill top and bottom
Drill, counterbore and spotface
Rough bore
Mill ends and pads
Semi-finish bore
Drill, counterbore and tap
Bore valve openings
Finish bore
Drill for spark plugs
Tap for sleeves
Water test
Crown face for sleeve

The cylinder block is an aluminum casting while the cylinder sleeve is a special alloy forging, threaded for a length of over 7 in. and screwed into the cylinder block the entire distance. This form of construction was originally adopted in order to secure an intimate contact between the cylinder sleeve and the aluminum casting which carries the water jacket, to more effectually conduct the heat away from the cylinder sleeve. In addition, there must be an intimate contact between the head of the cylinder sleeve and the top of the bore in the cylinder block.

The requirements for accuracy naturally demand great care in the molding and casting of the cylinder blocks. The way in which the castings are gated so as to insure an even flow of metal during the pouring operation is shown in Fig. 2. The metal is poured simultaneously into both ends of the mold through sprues shown at opposite corners and provision of ample risers on the top of the casting insures complete filling of the mold and affords opportunity for the escape of gases and small particles of dirt, thus assuring a sound casting. The castings are afterward annealed by heating to 600 deg. F. and allowed to cool slowly.

The importance of conducting the heat rapidly and uniformly is indicated by the close tolerance to which the cylinder-block castings are held. The thickness of the water-jacket wall may vary only $\frac{1}{32}$ in. plus or minus, from its nominal thickness of $\frac{11}{32}$ in. The water jacket is tested to 30 lb. pressure and is then treated to a coat of special enamel under a pressure of approximately 70 lb. as shown in Fig. 3. The sleeves are shown in place in this operation. When the enamel coating has dried the water jackets are again subjected to a 30-lb. pressure.

The close tolerances to which the water jackets are held make it necessary to lay out the cylinder blocks very carefully so as insure an even distribution of metal around the cylinder sleeves, after the blocks are bored and threaded. Because of this, each block is carefully laid out, a portion of the operation being shown in Fig. 4. Here the block is mounted in a laying-out fixture, the upper end being supported by the two arms *A* and *B* and the center by a small screw jack *C*. The lower end is suitably supported, the whole laying-out fixture being placed on a substantial laying-out table as shown. By blackening the casting at the end and scribing from each side, a center line is established after which the surface gage shown makes it easy to line up all the valve guide supports so they can be easily and accurately machined.

The central locating points are clearly marked with a sharp chisel and future measurements for laying out are taken from these points. With the cylinder block

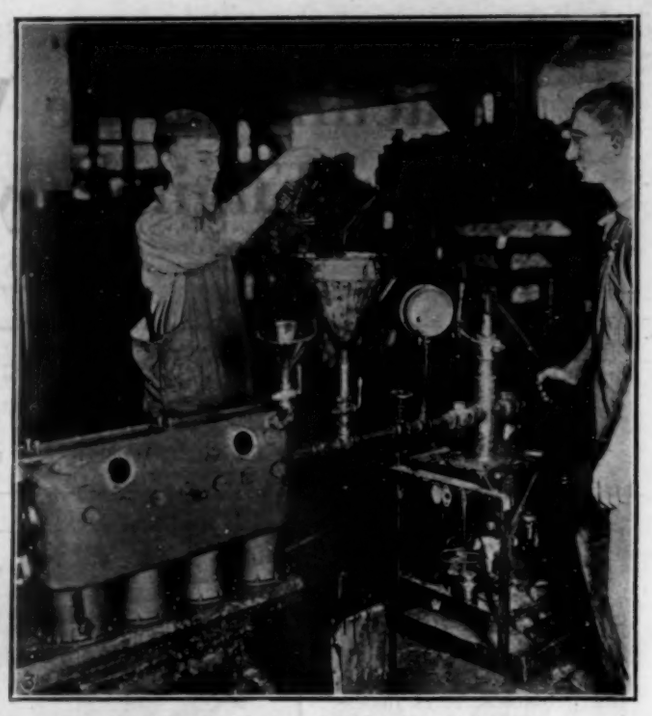


FIG. 2—GATING AND VENTING THE CASTING. FIG. 3—FORCING ENAMEL INSIDE WATER JACKET

properly supported, a center line is scribed around the entire block to assist in all of the layout work. A variation of $\frac{1}{32}$ in. is permissible in the center line, should it be necessary, to secure proper dimensions from the top dowel to the bearing holes on top of the cylinder for the vertical shaft which drives the camshaft.

Milling Both Ends

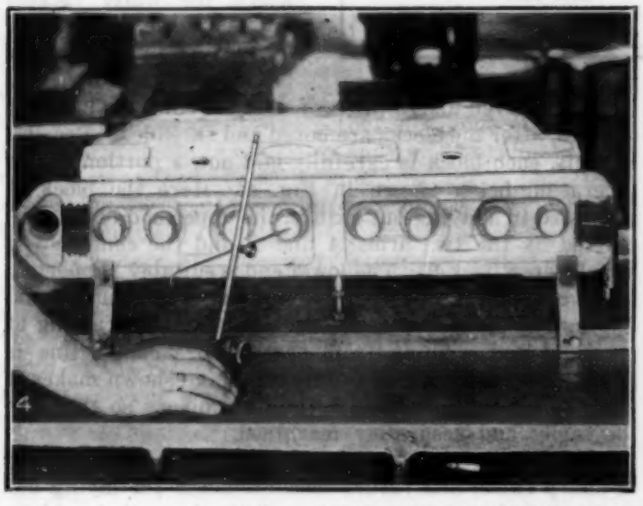
After the cylinder block is completely laid out, the first operation is to mill both the top and bottom surfaces. A plus or minus tolerance of 0.003 in. is allowed for the operation. This operation leaves approximately 0.015 in. on top of the cylinders for finish after the sleeves have been assembled in the cylinder block.

The standard method for milling the top and bottom surfaces is to use a pair of large straddle mills on a Cincinnati duplex milling machine, as shown in Fig. 5. The cylinder block shown, however, belongs to another motor. If this machine is not available the operation is done on a No. 6 Becker vertical milling machine with a 7-in. inserted tooth cutter. When it is necessary to use the alternate method, two operations are required and the block must be reversed.

A number of operations such as drilling, counterboring, spot facing and tapping follow. Then the four cylinder holes are rough bored in a Moline "holehog," as shown in Fig. 6, which leaves about $\frac{1}{8}$ in. for further boring operations and before tapping. The boring bars are shown in Fig. 7.

After several milling operations a second boring takes place which allows from 0.03 to 0.04 in. for the finish boring and crown facing. Numerous drilling and tapping operations follow, the valve openings are then bored, after which the cylinder blocks are finish bored ready for tapping. This operation also leaves from 0.017 to 0.023 in. in the bottoms of the holes for crown facing to the proper depth.

Then comes the operation of tapping the four cylinder holes to a diameter of 1.46 mm. and with a thread of 1.5 mm. pitch, to within $\frac{1}{32}$ in. of the bottom. In other



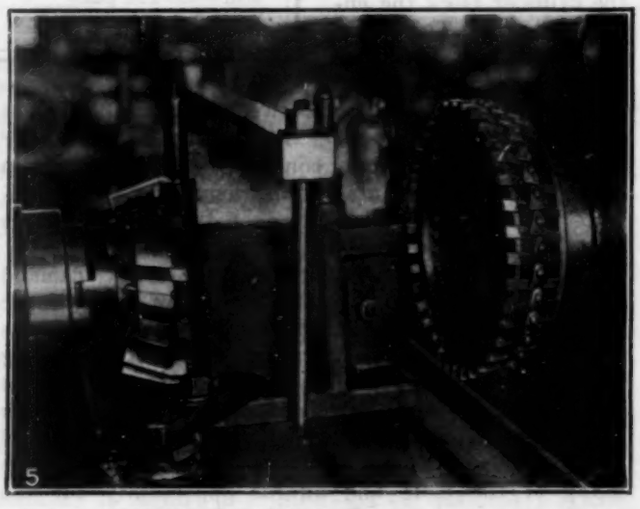


FIG. 4—LAYING OUT CYLINDER BLOCK. FIG. 5—MILLING TOP AND BOTTOM

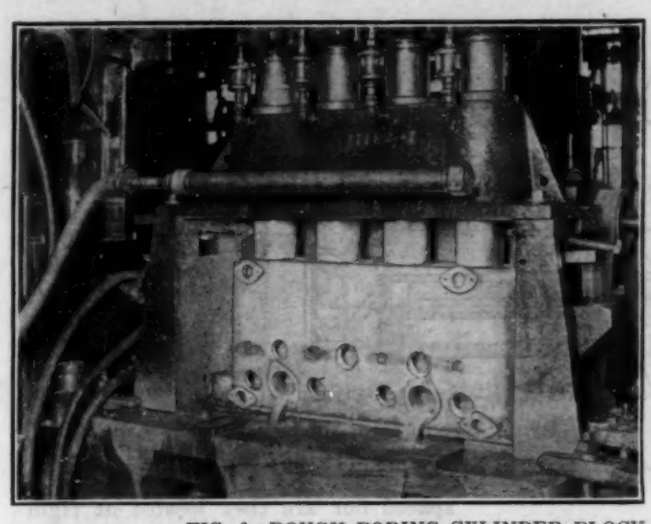


FIG. 6—ROUGH BORING CYLINDER BLOCK.

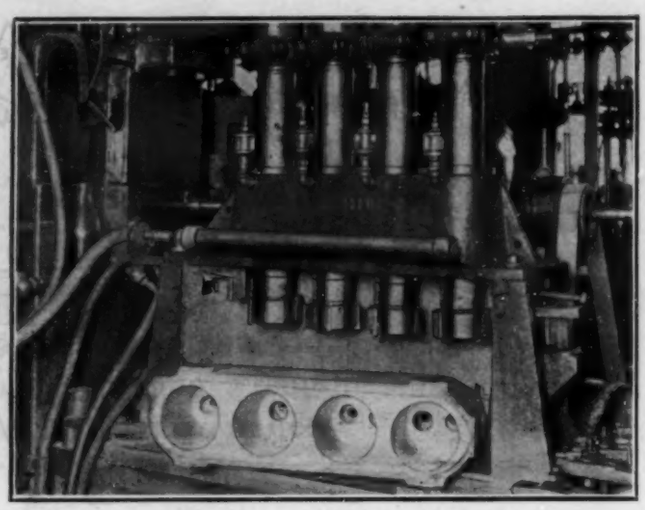


FIG. 7—THE KIND OF BORING BARS USED

words, the holes are tapped to a diameter of 5.748 in. with a U. S. form of thread a trifle over 18 pitch.

This threading is a somewhat unusual job, the collapsing tap shown in Fig. 9 being used for the purpose. The tripping arrangement is shown above the tap. It is not easy to tap a hole of this size over 7 in. long and maintain a smooth thread as well as secure the desired diameter and accuracy of lead. The tapping is done on a Colburn drilling machine, and in order to mantain the proper lead, the spindle has a lead screw cut on its upper end, the threads running in a bronze nut. Alternate teeth of the tap are ground away, giving more chip clearance and producing very smooth threads. The tapped holes are very carefully checked, a thread pluggage being used. In addition, the last hole tapped is

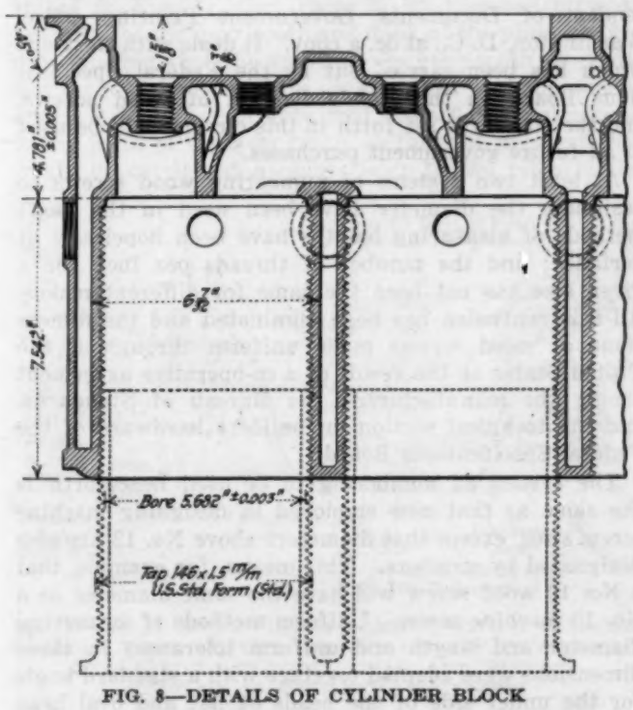


FIG. 8—DETAILS OF CYLINDER BLOCK

tested by having a standard cylinder sleeve screwed into place to a depth of four inches. A water test of 28 lb. pressure follows.

Next in order is the crown facing of the four cylinder holes so as to make perfect seats for the ends of the cylinder sleeves when they are screwed into place. In order to insure a perfect fit across the top of the cylinder sleeves, it has been found advisable to crown the bottoms of the holes in the blocks from 0.003 to 0.005 in. The cylinder sleeve is thus forced to bear first in the center and this method has been found very satisfactory in securing a 90 per cent contact between the head of the sleeve and the aluminum casting. Without

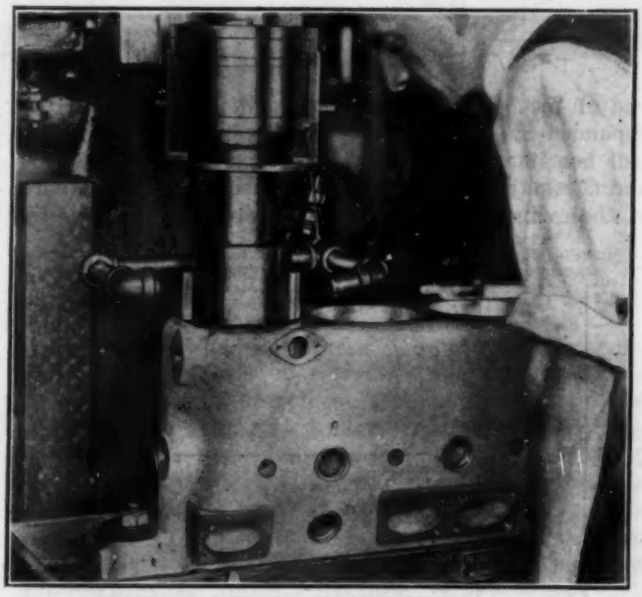


FIG. 9—TAPPING THE CYLINDER BLOCK

such a contact it has been found difficult to keep the head cool enough to prevent warping of the valve seat and its consequent injurious effect on the functioning of the engine. By making the cylinder head somewhat thicker and crowning the seat in the cylinder block, as previously mentioned, this difficulty has been entirely overcome. The tool used in facing the crown and the gage for testing the work, are shown in Figs. 10 and 11, respectively.

The facing of the crown is a very particular job as at least a 90 per cent bearing must be secured. This means that the crown must be at right angles to the bore of the cylinder block and so the threaded hole is used as a guide. The vital part of the facing tool, shown in Fig. 10, is the expansion bushing *A* which is threaded at each end and relieved in the center. Each

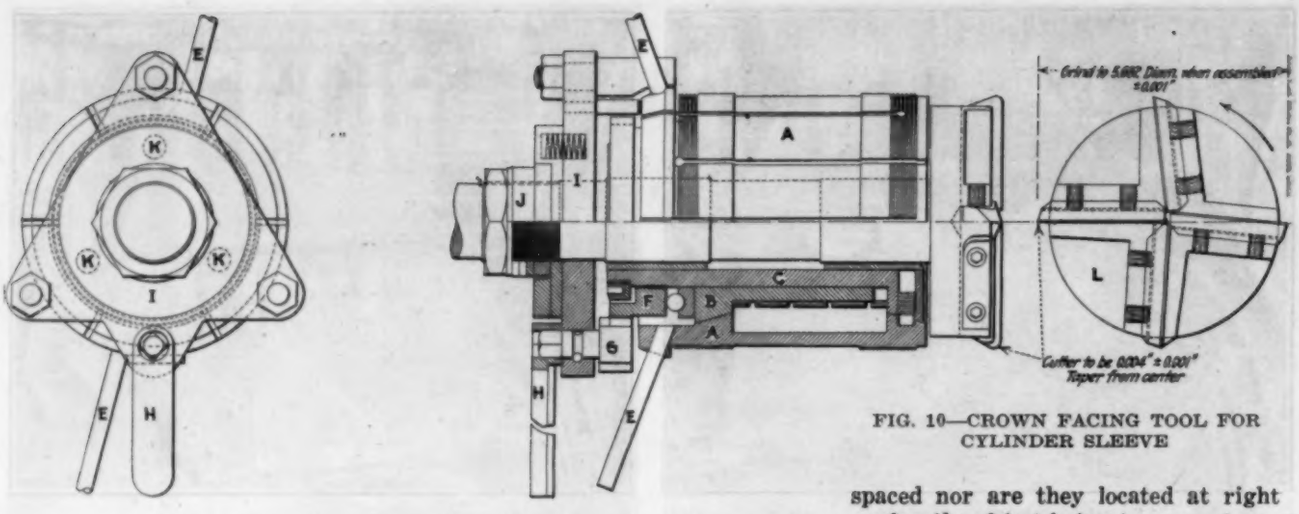


FIG. 10—CROWN FACING TOOL FOR CYLINDER SLEEVE

end of the bushing is tapered inside so that it can be expanded by means of the nut *F* which, acting on the ball bearing shown, draws the tapered portions of *B* and *C* together and expands the bushing to fill the bore of the cylinder. The bushing is screwed into place by means of the forked driver *D* whose ends go over the pins *E*. The nut *F* has a 54-tooth, 12-pitch gear cut on the outside and is turned by the 12-tooth pinion *G* by means of the handle *H*. The pinion is carried in the triangular plate *I* which is removed while the bushing is being screwed into place. It is replaced after the bushing *A* has been run in until it is stopped by the shoulder at the top.

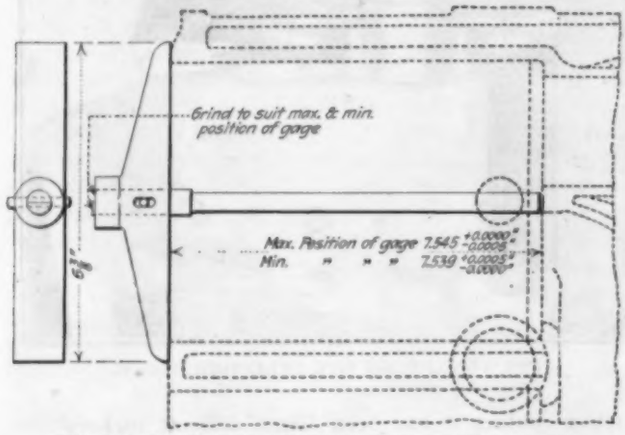


FIG. 11—GAGE FOR TESTING THE CROWN FACE

The triangular plate is fastened in place by the nuts shown at *J* and the depth to which the facing cutter can be fed into the cylinder is controlled by the three stop pins *K*. The arrangement of the facing cutters is shown at *L*. The cutters, it will be noted, are not regularly spaced nor are they located at right angles, the object being to prevent any tendency to chatter and to secure an angular shearing cut with some of the blades. The cutters are ground 0.004 in. taper, the center being lower than the outer diameter. The tolerance is plus or minus 0.001 inch.

The gage, shown in Fig. 11, is of the flush pin type. The tolerance of the work is shown in a somewhat unusual manner.

Standardization of Wood Screws

Circular No. 140 of the Bureau of Standards has just been issued and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. a copy. It deals with the work which has been carried out by the Federal Specifications Board on the standardization of wood screws, and the standards set forth in this circular will be used in all future government purchases.

At least two systems of numbering wood screws to designate the diameter have been used in the past; methods of measuring lengths have been hopelessly at variance; and the number of threads per inch for a given size has not been the same for different makes. All this confusion has been eliminated and the dimensions of wood screws made uniform throughout the United States as the result of a co-operative agreement among the manufacturers, the Bureau of Standards, and the technical section on builders hardware of the Federal Specifications Board.

The system of numbering to be used henceforth is the same as that now employed in designing machine screw sizes, except that diameters above No. 12 are also designated by numbers. This means, for example, that a No. 10 wood screw will have the same diameter as a No. 10 machine screw. Uniform methods of measuring diameter and length and uniform tolerances in these dimensions were adopted together with a standard angle for the under side of the heads of flat and oval head screws. The number of sizes of brass and steel screws manufactured as standard was reduced from 555 to 291, a reduction of 47 per cent, while at the same time retaining a sufficient variety for every need. This reduction should benefit the manufacturer, the dealer, and the user.

Factors Governing the Strength of Gear Teeth

By DOUGLAS T. HAMILTON

The third article—Number of teeth and tooth ratio of gears in mesh—Increasing strength of pinions having a small number of teeth

AN INCREASE in the number of teeth in the gear improves its strength, all other factors remaining the same. The effective strength of a gear, however, when brought into mesh with another gear is governed to a greater or less extent by the pressure angle, length of the addendum and the tooth ratio of the gears in mesh. The difference in the effective strength is more noticeable in gears having a small number of teeth, small pressure angle and so-called standard addendum, than is the case where the pressure angle is greater and the teeth "stubbed." The chief contributing factor responsible for this condition is interference, especially when small numbers of teeth are used. The examples following will serve to make this point clear.

A graphical analysis of this particular tooth ratio from the standpoint of strength, using a standard addendum and 14½ deg. pressure angle, shows, as illustrated in Fig. 11, that there is interference between the point of the gear tooth and flank of the pinion tooth, necessitating that the point of the gear tooth be modified for a distance slightly greater than ¼ of the addendum. It is plain, therefore, that contact does not extend to the point of the gear tooth, so that the greatest load would be carried at a point closer to the pitch circle,

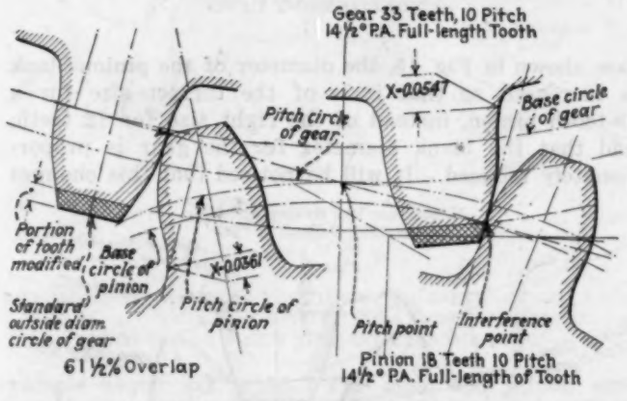


FIG. 11—AN 18-TOOTH PINION IN MESH WITH A 33-TOOTH GEAR, SHOWING THE AMOUNT OF MODIFICATION REQUIRED ON 33-TOOTH GEAR, AND RESULTANT GAIN IN EFFECTIVE STRENGTH

thus favorably strengthening the gear tooth. As the value of *X* indicates, the gear tooth when brought into mesh with an 18-tooth pinion is 51 per cent stronger than the pinion tooth. It is about 21¼ per cent stronger than an unmodified 33-tooth gear of the same tooth proportions. Modifying the point of the tooth, of course, reduces the arc of action, but in this case it still leaves a 61½ per cent overlap, which is more than is necessary for the best tooth action.

If the pressure angle is increased to 20 deg. and the teeth stubbed, so that the addendum is $\frac{8}{10}$ of an inch

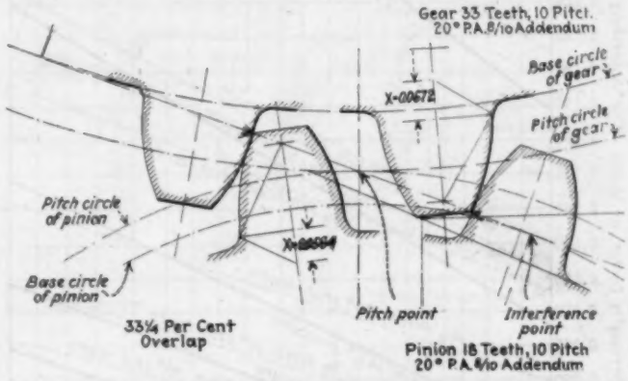


FIG. 12—PRESSURE ANGLE INCREASED, TOOTH SHORTENED AND THUS INTERFERENCE AVOIDED

(figuring on a basis of a 1-diametral pitch gear), as shown in Fig. 12, interference is eliminated and the teeth of both gear and pinion are strengthened. By shortening the addendum and increasing the pressure angle, the pinion tooth has been strengthened 56¼ per cent and the gear tooth about 23 per cent. There is only about 19 per cent difference in strength between gear and pinion tooth, as compared with 51 per cent difference in the previous example. There is also sufficient overlap—33¼ per cent—to assure satisfactory tooth action.

A comparison of these two examples and the chart in Fig. 13 goes far towards explaining the advantages of the stubbed over the full-length tooth, especially when gears having small numbers of teeth are involved.

Suppose for comparison that we have a condition where 24 and 33 teeth are in mesh. If the pressure angle is 14½ deg. and a standard-length addendum is used, as shown in Fig. 14, no interference is present. Hence the gear tooth requires no modification, and consequently the greatest load is carried at the point of the tooth. This load necessarily changes the strength value of the gear tooth, and as there is an increased number of teeth in the pinion, its strength is also effected.

A comparison of the gear forms in Figs. 11 and 14,

shows that the gear is 21¼ per cent weaker when in contact with a 24-tooth pinion, than is the case when it is operating with an 18-tooth pinion. Increasing the number of teeth in the pinion from 18 to 24, improves the strength of the pinion about 12½ per cent. It will also be noticed in Fig. 14 that with an overlap of 91¼ per cent there are practically two teeth in mesh throughout the entire arc of action.

When it is necessary to use a pinion having a small number of teeth, the shape of the pinion tooth should be given careful consideration. The two main points to consider are the strength and the ratio of the normal pitch to the length of the line of action. In the first

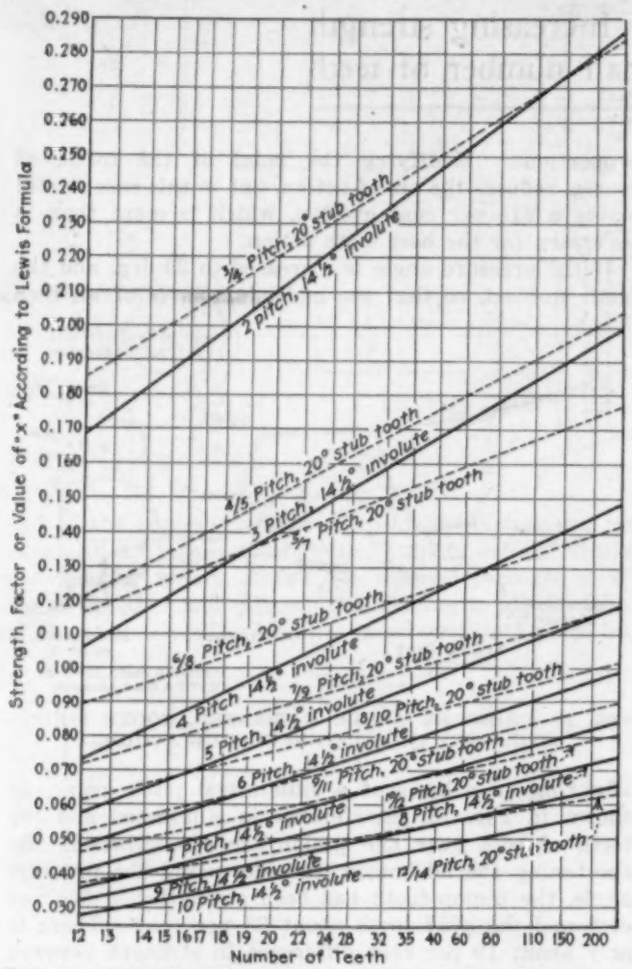

Strength Factor or Value of "x" According to Lewis Formula
Number of Teeth
3/8 Pitch, 20° stub tooth
2 pitch, 14½° involute
4/5 Pitch, 20° stub tooth
3 Pitch, 14½° involute
3/7 Pitch, 20° stub tooth
6/8 Pitch, 20° stub tooth
4 Pitch 14½° involute
7/9 Pitch, 20° stub tooth
5 Pitch, 14½° involute
8/10 Pitch, 20° stub tooth
6 Pitch, 14½° involute
9/11 Pitch, 20° stub tooth
7 Pitch, 14½° involute
10/12 Pitch, 20° stub tooth
8 Pitch, 14½° involute
9 Pitch, 14½° involute
11/14 Pitch, 20° stub tooth
10 Pitch, 14½° involute

FIG. 13—COMPARATIVE STRENGTH OF DIFFERENT NUMBERS OF TEETH AND ALSO FULL-LENGTH 14½ DEG. AND 20 DEG. STUB TEETH

article of this series, the relations of the various tooth elements to the strength of the tooth were considered. It was shown that of all the variable factors, the length of the addendum had the most pronounced effect on the strength of the tooth, all other factors, of course, remaining constant. Shortening the addendum of the tooth decreases the arc of action, and it does not have much effect on reducing the undercut of the tooth, unless coupled with a pressure angle that is great enough to eliminate this undesirable condition.

There are a number of methods in use for increasing the strength of pinions having a small number of teeth. Some of these have a comparatively limited application, if the best possible results are to be obtained, whereas others are capable of wider application. The most commonly used methods will now be discussed.

In the case of a pinion having a small number of teeth, coupled with a small pressure angle, it is the inevitable undercut of the pinion tooth that weakens it. Conceding that we have a case where it is impossible to increase the center distance or the number of teeth,

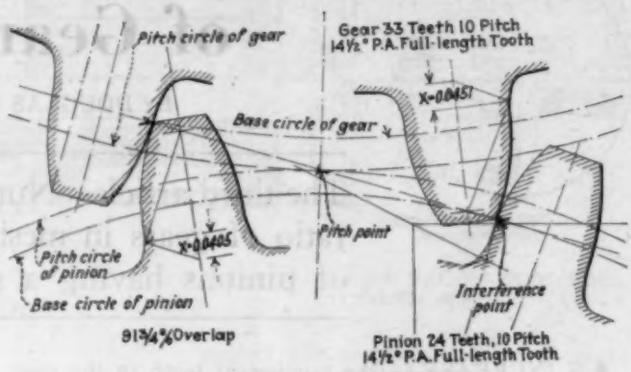


FIG. 14—A 24- AND 33-TOOTH RATIO

there are several methods that can be used for strengthening the pinion tooth.

In Fig. 15 is shown one method, which consists in using an enlarged blank diameter for the pinion, and a reduced-size blank for the gear. Suppose that in the

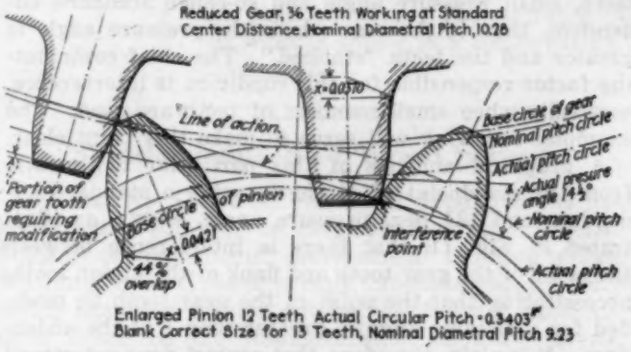

Reduced Gear, 36 Teeth Working at Standard Center Distance. Nominal Diametral Pitch, 10.28
X=0.0370
Line of action
Base circle of gear
Nominal pitch circle
Actual pitch circle
Actual pressure angle 14½°
Nominal pitch circle
Portion of gear tooth requiring modification
Base circle of pinion
X=0.0421
Interference point
44% overlap
Actual pitch circle
Enlarged Pinion 12 Teeth Actual Circular Pitch=0.3403"
Blank Correct Size for 13 Teeth, Nominal Diametral Pitch 9.23

FIG. 15—ENLARGED PINION BLANK OPERATING WITH UNDERSIZED GEAR BLANK SHOWING THAT PINION TOOTH IS STRONGER THAN GEAR TOOTH DUE TO THE EXCESSIVE AMOUNT OF ENLARGEMENT USED

case shown in Fig. 15, the diameter of the pinion blank is increased so that it is of the correct size for a 13-tooth pinion, instead of the right size for 12 teeth, and that the blank diameter for the gear is proportionately reduced. It will be noticed that this changes

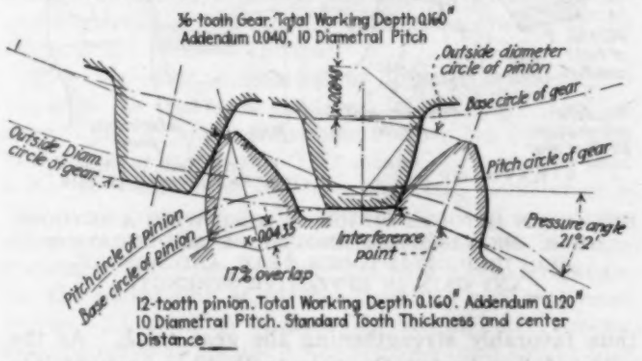

36-tooth Gear. Total Working Depth 0.160"
Addendum 0.040", 10 Diametral Pitch
Outside diameter circle of pinion
X=0.0084
Base circle of gear
Outside Diam. circle of gear
Pitch circle of gear
Pressure angle 21½°
Pitch circle of pinion
Base circle of pinion
X=0.0435
Interference point
17% overlap
12-tooth pinion. Total Working Depth 0.160". Addendum 0.120"
10 Diametral Pitch. Standard Tooth Thickness and center Distance

FIG. 16—LONG AND SHORT ADDENDUM GEARS BASED ON HAVING THE LENGTH OF THE ADDENDUM PROPORTIONAL TO THE TOOTH RATIO SHOWING STRENGTH OF GEAR TOOTH AS COMPARED WITH PINION

all of the elements of the teeth, with the one exception of the number of teeth. The circular pitch, diametral pitch, pitch diameter and addendum are changed. If a standard cutter, fed into standard depth is used to cut both gear and pinion, their forms will be as shown in Fig. 15. The flank of the pinion is not undercut, and is much thicker at the base than a standard tooth, whereas the thickness of the gear tooth at the base is considerably reduced.

In this particular case, an excessive amount of enlargement has been used, so that actually the gear tooth is 13¾ per cent weaker than the pinion tooth. If an actual example of this nature were to be solved, it would be necessary to make several trials, in order to determine the amount of enlargement of the pinion necessary to bring it equal in strength to the gear. In this case the pinion blank was enlarged about 7½ per cent. An

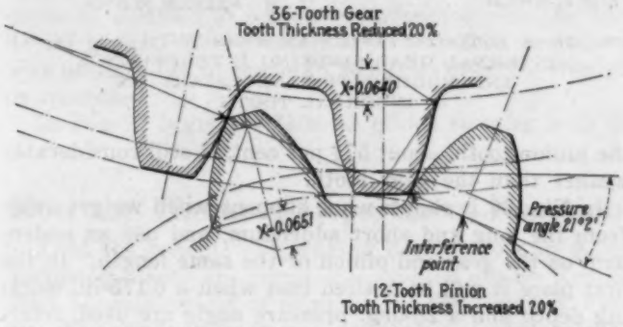


FIG. 17—SAME TOOTH RATIO AS IN FIG. 16, BUT PINION TOOTH HAS BEEN THICKENED AND GEAR TOOTH REDUCED TO INCREASE STRENGTH OF PINION TOOTH

enlargement of about 5 per cent would have made the strength of the gear and pinion teeth approximately equal.

Several other interesting facts connected with this

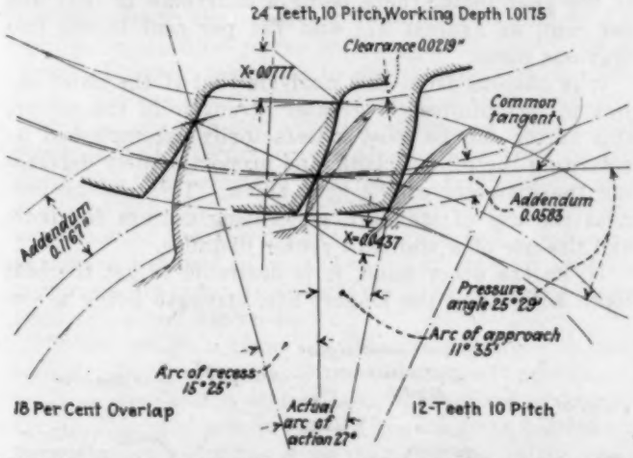


FIG. 18—A 12- AND 24-TOOTH RATIO WITH LONG AND SHORT ADDENDUM SHOWING THAT THE PRESSURE ANGLE HAS BEEN GREATLY INCREASED

example should be noted. The gear and pinion are shown operating at a pressure angle of 14½ deg. This condition, however, would not be the case if the same pinion were brought into mesh with a standard-size gear, and of course operating at an increased center distance. The pressure angle would then be about 18¾ deg. If the gear were enlarged in the same proportion as the pinion, that is the blank diameter increased 0.100 in., the pressure angle would be about 24 deg. It is evident, considering the involute curve in its broadest sense, that:

(1) An involute has no pressure angle until it is brought into contact with another involute or rack;

(2) The pressure angle is determined by the center distance of the base circles;

(3) An involute has no pitch diameter until brought into contact with another involute or rack;

(4) The pitch diameter of an involute contacting another involute is determined by the center distance.

Another Method of Laying Out the Addendums

Another method of laying out long and short addendum gears, is to make the addendum of the pinion and gear, respectively, proportional to the ratio between the number of teeth. Taking the case of 12 and 36 teeth, and laying out the tooth proportions on the plan just mentioned, the simplest course to pursue, is to calculate the tooth proportions on a 1-diametral pitch basis. The actual length of the addendum on the gear and pinion can then be determined by dividing the result by the diametral pitch used, as will be explained later.

To obtain the length of the addendum, it is first necessary to decide on the working depth. Assuming in this case that we use a "stubbed" tooth, having an addendum

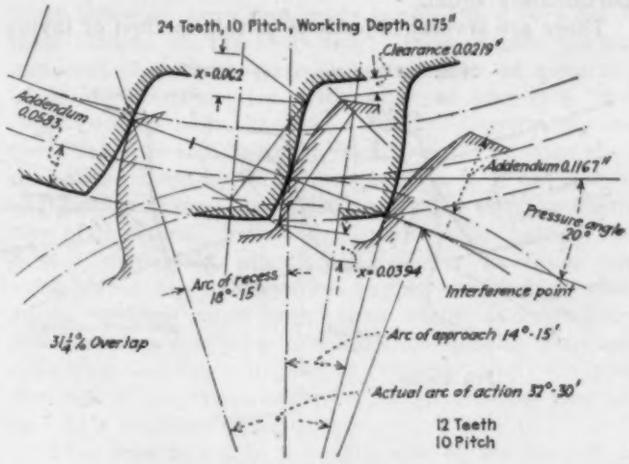


FIG. 19—SAME TOOTH RATIO AS IN FIG. 18, BUT PRESSURE ANGLE HAS BEEN REDUCED TO 20 DEG. LONG AND SHORT ADDENDUM TEETH RETAINED

of $\frac{1}{10}$ in. (for 1-diametral pitch), the working depth would be $\frac{1}{10} \times 2$, or 1.6 in., and the total depth 1.8 inch.

First add together the number of teeth in the gear and pinion, in this case, $12 + 36 = 48$. Then $\frac{12}{48}$ of 1.6 = length of the addendum on the gear, and $\frac{36}{48}$ of 1.6 = length of addendum on the pinion. The actual length of the addendum for a 10-pitch gear and pinion of these proportions would be: $\frac{36}{48}$ of $\frac{1.6}{10}$ = 0.120 in. for the pinion and $\frac{12}{48}$ of $\frac{1.6}{10}$ = 0.040 in. for the gear. By this method, the base circle of the pinion is determined by the outside diameter circle of the gear, and the base circle of the gear by the outside diameter of the pinion, as is shown in Fig. 16. The pressure angle can be obtained by the following formula:

To find the pressure angle, when the number of teeth in the gear and pinion and working depth are known, first find the length of the addendum, as previously

explained, then the pressure angle is found as follows:

$$\text{Cos of pressure angle} = \frac{\text{pitch radius of gear} - \text{addendum of pinion}}{\text{pitch radius of gear}}$$

The gear and pinion are laid out in Fig. 16 to the shape that would be produced by using cutters having the reverse tooth elements of those of the gears cut. That is to say, the cutter for the gear would have a long addendum, and that for the pinion a short addendum. This method, with this particular tooth ratio and proportions, produces a gear tooth that is 95 per cent stronger than the pinion tooth. This objection can be overcome by using a cutter for the gear which will reduce the thickness of the gear tooth, and a cutter for the pinion that will cut a tooth space to correspond with the reduced gear tooth. The pinion tooth, of course, would be made proportionately thicker. The proportional amount of increase and decrease in tooth thickness, should be in the ratio of about ¼ the amount that the gear tooth is stronger than that of the pinion. In this particular case, if we reduce the thickness of the gear tooth 20 per cent and increase that of the pinion a proportional amount, as will be observed from an inspection of Fig. 17, their strength values become proportionately equal.

There are several objections to this method of laying

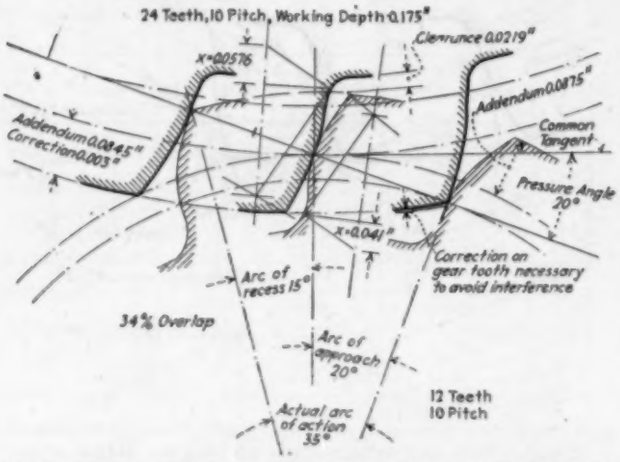


FIG. 20—SAME TOOTH RATIO AS IN FIG. 18, BUT PRESSURE ANGLE REDUCED TO 20 DEG. AND ADDENDUM ON PINION AND GEAR OF EQUAL LENGTH

out long and short addendum gears. In the first place with high tooth ratios, and small numbers of teeth in the pinion, the pressure angle is generally excessively high. In the second place, the method requires the use of special cutters, which is objectionable, unless a large number of gears of one particular size is required. An increase in the length of the addendum, increases the pressure angle, and a reduction in the addendum shortens the arc of action. A compromise between several factors is necessary if the best results are desired. With this particular ratio, better results would have been obtained by using 1.7 in. (for 1-diametral pitch) instead of 1.6 in. for the working depth.

In Figs. 18, 19 and 20 are shown the results obtained by using different combinations of pressure angles and base circle diameters for a 12- to 24-tooth ratio set of gears. In Fig. 18, a working depth of 0.175 in. is used, and the addendum of gear and pinion are in the same ratio as the number of teeth, the base circles being controlled in the same manner as in Fig. 16. The teeth are laid out to standard tooth thickness on the normal pitch circle, and it will be noted in Fig. 18 that the pinion is 77¾ per cent weaker than the gear. The pressure angle is rather high, and there is not sufficient overlapping of the teeth to give the best action.

In Fig. 19 the same proportional addendums are used, but the pressure angle is reduced to 20 deg. This reduction results in assuring 31¼ per cent overlap, but

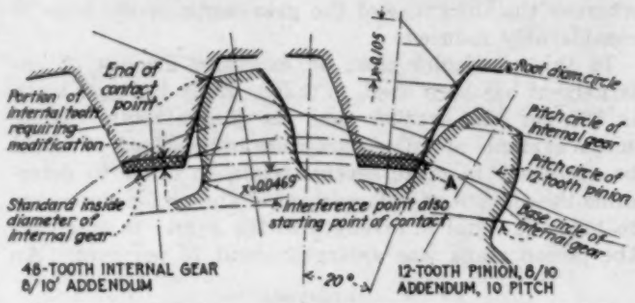

x=0.105
Root diam. circle
End of contact point
Portion of internal tooth requiring modification
Pitch circle of internal gear
Pitch circle of 12-tooth pinion
x=0.0469
Standard inside diameter of internal gear
Interference point also starting point of contact
Base circle of internal gear
48-TOOTH INTERNAL GEAR 8/10 ADDENDUM
20°
12-TOOTH PINION, 8/10 ADDENDUM, 10 PITCH

FIG. 21—A 12-TOOTH PINION IN MESH WITH A 48-TOOTH INTERNAL GEAR SHOWING INTERFERENCE AND MODIFICATION NECESSARY ON INTERNAL TOOTH

the pinion tooth, about 57¼ per cent, is still considerably weaker than the gear tooth.

In Fig. 20 is shown what happens when we get away from the long and short addendum, and use an addendum on the gear and pinion of the same length. In the first place it will be noticed that when a 0.175-in. working depth and a 20-deg. pressure angle are used, interference between the point of the gear tooth and the flank of the pinion tooth results. The amount is very slight extending down on the involute for only about 0.003 in. The length of the line of action is increased but it will be noticed that the arc of approach is greater than the arc of recess, which is just the reverse of what is required to assure the best tooth action. The pinion tooth, however, more closely approaches in strength that of the gear tooth, there being a difference of only 40¼ per cent, as against 57¼ and 77¾ per cent in the two previous cases.

It is obvious from this analysis that if the chief object to be obtained is greater strength in the pinion, this factor can be most satisfactorily accomplished by enlarging the pinion blank, and proportionately decreasing the diameter of the gear blank. This change permits the use of standard generating cutters for both, and the use of a standard center distance.

If, on the other hand, it is desirable to get the best tooth action and the longest life, strength being a sec-

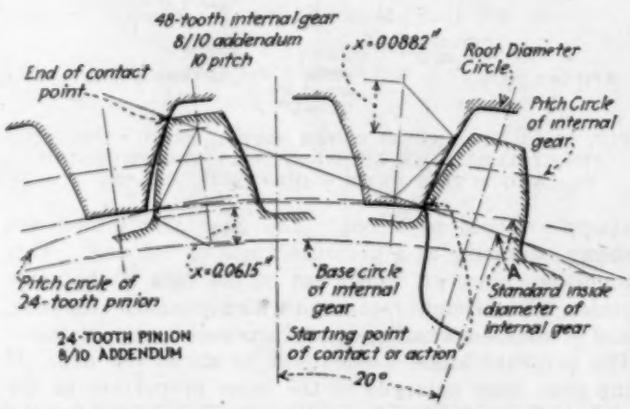

48-tooth internal gear 8/10 addendum 10 pitch
x=0.0882"
Root Diameter Circle
End of contact point
Pitch Circle of internal gear
Pitch circle of 24-tooth pinion
x=0.0615"
Base circle of internal gear
Standard inside diameter of internal gear
24-TOOTH PINION 8/10 ADDENDUM
Starting point of contact or action
20°

FIG. 22—A 24-TOOTH PINION IN MESH WITH SAME GEAR SHOWING AVOIDANCE OF INTERFERENCE; THE EFFECTIVE STRENGTH OF THE INTERNAL TOOTH IS LESS THAN IN FIG. 21

ondary consideration, then both pinion and gear blank should be enlarged in the same proportion, and the center distance increased. Of course, if a large number of gears of one particular size are to be cut, then the use of special cutters will make possible the obtainment of both results, by using long and short addendum gears, and making the pinion tooth thicker than the gear tooth.

There are three main factors that govern the strength of an internal gear, the length of addendum, pressure angle and tooth ratio, in conjunction, of course, with the number of teeth in the gear. In Fig. 21 is shown a 12-tooth pinion operating with an internal gear having 48 teeth. The pressure angle is 20 deg. and the addendum 0.080 in. for 10-pitch. Tooth action in this case starts at the interference point, and the internal tooth which extends inside of the interference point must be modified to prevent interference with the flank of the pinion. The greatest load, therefore, is not carried on the point of the tooth, hence its effective strength is increased.

In Fig. 22 is given a 24-tooth pinion running with the same gear. No interference in this case is present, and the contact, instead of starting at the interference point *A*, takes place further along the line of action. In fact, the starting point of action in this case is determined by the inside diameter of the internal gear, and is located at a point where the inside diameter circle cuts the line of action. The greatest load is, in this case, carried on the point of the tooth, so that its effective strength is less than in Fig. 21, about 19 per cent being the difference.

If a pressure angle of 14½ deg. and a standard length addendum had been used, the difference in strength would have been still greater, and the internal gear tooth would have required modification for a greater portion of its length. Due to the decreased pressure angle and longer addendum, the 12-tooth pinion would also have been weakened. In laying out internal gear teeth the question of strength, especially for high ratios, should always be given careful consideration.

[On page 900 appears an illustration, omitted from the second article, and several corrections made necessary by that omission.—ED.]

How the Planning Department Functions

That the benefits of planning departments in manufacturing plants are many, was pointed out by Keppele Hall, superintendent of planning for the Joseph & Fiess Co., Cleveland, Ohio, in a paper that was read recently at the meeting of the Taylor Society held in Syracuse, N. Y. Cost of production, rapidity of work, better satisfaction among the workmen and closer co-operation are some of the results that have been obtained, according to Mr. Hall. He further explains:

"Any industrial organization presents a complex study from the standpoint of science. For we have to reckon with physical forces in the application of mechanisms to the processes of production and deal as well with spiritual forces in the relationships between human beings. We have to deal not only with chemistry, physics, mechanics and mathematics, but with ethics, psychology and all the problems of human relations as well. Taylor covers all of these when he lays down the fundamentals of scientific management as a study of the job, a study of the individual, the proper allocation of the individual to the job, and a full realization on the part of management of its ever growing responsibility when it undertakes to direct these industrial and social activities.

"When we fit a planning department into a modern industrial organization with the distinct purpose of making it a useful and reliable instrument of control for the highest executives, we follow quite logically a little further along the same path that led to the original conception of such a department. Originally it was intended as an office in which the preliminaries to starting a piece of work could be arranged before the order for it was delivered to the shop. This meant confining a considerable amount of clerical work to a shop office instead of having it done on the work floor.

EACH MAN TO HIS OWN WORK

"Skilled mechanics and other workers who had previously done this kind of work were relieved of it and enabled to devote their full time to the work for which they were trained. At the same time clerical workers in the office performed much more efficiently and at much less cost, work previously handled in a very hit or miss fashion on the shop floor. It very soon became apparent that there were numerous jobs of a variety of kinds in connection with work of the shop that could be done beforehand in a clerical department, and there followed rapidly the development of the shop planning department as we know it today. In it are located various functions all contributing to the efficient operation of the work. Preparing designs, specifications and bills of materials, scheduling jobs for machines and work places, controlling stores supply, establishing standards, setting rates from time study and analysis, standardizing machines and tools, computing earnings, compiling costs, maintaining records and devising methods of procedure and practice all are now centralized in a planning department.

"This department is primarily one of service. It is performing for other departments certain tasks that have to be done by someone, somewhere, somehow; and by its performance is lowering the cost of production.

"No more striking proof of this can be offered than that evidenced by the fact that today practically every industrial concern with any pretension to importance boasts its 'planning department.' Most of these are far from being scientifically conceived or operated according to our proven theories, but they undoubtedly indicate that industry with a growing consciousness of its imperative need is reaching out for something better in management, and is inevitably approaching a realization of where that need may be satisfied.

"The last two or three years have witnessed a revolution in our conception of business. Economists are emphasizing the fact that our capacity for production, expanded to supply the needs of war, may be fully utilized in times of peace only if this output can be delivered at a price which will permit and induce the public to consume it; that the surplus of producing facilities will in the end tend to reduce prices by means of more efficient management evidenced in improved methods of purchasing, manufacture and marketing. In other words the elements of finance, production and sales must be co-ordinated and business must be studied and treated as a whole and no longer as a collection of separate and often competing units."

Book Reviews

Practical Perspective. By Frank Richards and Fred. H. Colvin, with a chapter on true perspective by C. W. Reinhardt. Fifth edition, revised and enlarged, limp cloth covers, 4½x7 in., 69 pages and 73 illustrations. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York City. Price $1.

This book is a treatise on practical perspective and shows just how all kinds of mechanical drawings can be made by this method. It explains how simple it is to sketch work in perspective so that any mechanic can understand what is wanted without the use of working drawings, and in addition shows that by the use of this method of drawing much time is saved in the drawing room.

The principles of isometric perspective are enumerated by Mr. Richards in the first chapter. This chapter gives a careful analysis of each detail of the subject, explaining each step with illustrations, and furthermore sets forth these details in such a simple, familiar way that the common every-day shop folks will be able to grasp them without much difficulty. In order to overcome the difficulty of readily describing ellipses, which has much to do with preventing the more general use of the isometric, a detailed and thorough examination of their construction is given.

With these principles set forth, the next chapter, by Mr. Colvin, discloses how to use the D-C isometric sketching paper, which greatly simplifies the construction of isometric drawings. The instructions are all illustrated and begin with the simplest forms, gradually taking up the more complicated problems and finally showing the methods by which assembled machines and architectural details are handled. In addition, the adaptability of this paper for lettering the captions on maps and working drawings is shown.

The last chapter of this book, by Mr. Reinhardt, is devoted to the general and elementary principles of true perspective. This article is given with the purpose of presenting the subject in a thoroughly practical and easily understood way so that the ordinary layman may readily comprehend and promptly apply the knowledge and information set forth. A number of rules and illustrated explanations are given, which if carefully noted and copied, demonstrate the principles of correct perspective in such a way that the average reader should be enabled to sketch simple perspectives with ease.

Essentials of Drafting. By Carl L. Svenson, assistant professor of engineering drawing in the Ohio State University. Second edition—revised and enlarged. One hundred and ninety-three 6x9 in. pages, cloth boards, 450 illustrations and 250 problems and layouts. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price $1.75.

A book that should aid all students of mechanical drafting since it is devised for the express purpose of supplying the fundamental principles and theories of that study. The wide variety of subjects taken up in this book are necessarily only briefly treated as it is intended that personal instruction and guidance should go hand in hand with the study.

The first studies deal with the methods of handling drawing equipment, a detailed account of the character of lines and how and where the lettering should be done. All these instructions are illustrated for clearness. As an aid to the construction of parts, a chapter is devoted to plane geometry figures in which the methods of drawing the various geometric forms together with a brief analysis regarding this particular subject are given.

Orthographic, isometric and oblique projections are treated in detail as the methods by which objects may be represented to show their true size and shape. Another chapter gives an account of how the two classes of working drawings, namely: detail and assembly drawings, are made. To insure that the student knows how to truly represent the size of some object, a chapter is devoted to dimensions, that fully explains the essential points concerning the manner in which dimensions should be placed on a drawing.

As an aid to machine construction a knowledge of what is involved in the process of machining is given. In addition screw threads, bolts and screws, and riveting are briefly discussed to insure a working knowledge of their uses in machine design.

Several chapters are devoted to descriptive geometry in which intersections and developments of surfaces are analyzed. The properties of materials and the stresses to which they are subjected are also briefly treated so that drawings involving various materials may be intelligently made. Other chapters are devoted to such subjects as sketching, shading, piping and sections.

Handy Men—Discussion

By Wm. J. Fisher, Jr.

There recently appeared on page 514, Vol. 58 of the *American Machinist* an article entitled, "Handy Men," in which the writer tells about one shop where the electrician spends part of his time smoking cigarettes; the oiler, gossiping; the millwright, the carpenter and handy man arguing about the best way to do things, and all of them wasting more than 50 per cent of their time.

Was not this the fault of the superintendent, who allowed such conditions? "Handy men," as Mr. Walter recommends, would remedy this condition very promptly for if the millwright had been of this type, he could have made the boxes during his idle time, which would have released the carpenter altogether. Furthermore, the repair man could have done the small amount of necessary oiling and electric work.

The millwright referred to in the article surely never deserved that title. Whoever heard of a millwright that set a lathe by hurriedly bolting the countershaft to the angle iron above, setting the ends of the lathe on wooden blocks and lining the lathe with the shaft by dropping a bolt down on a piece of binder twine? No true millwright is without a plumb-bob and level. In the case mentioned, the millwright should have first lined his countershaft with the main driving shaft, leveled it, then lined and leveled the lathe and poured concrete under the feet of the lathe. Then he would have made a good job, and the trouble experienced in the case mentioned would not have taken place.

There are a number of handy men in our shop who are trained in certain branches of our mechanical work in which they show the greatest proficiency. They are very valuable men, and do not spend any of their time in idleness.

Safeguarding Industry by Stabilizing Employment

BY WILLFORD I. KING
Bureau of Economic Research, New York

Voluntary and involuntary unemployment—Small plants lay off lower proportion of employees than large plants — Measures of business—What to do during periods of depression and prosperity

DOUBTLESS many of you will wonder that an economist should have the temerity to appear before you to discuss problems of factory employment and finance—especially when he must admit that he has had no extensive experience in hiring men and has but occasionally been inside a factory. Those of you, however, who read *Der Waldschulmeister* at college will remember how the quaint old man called attention to the difficulty of seeing the forest for the trees. Since this difficulty is a real one, perhaps I may be able to point out to you some of the more obscure characteristics of the forest even though you know infinitely more about the trees than I can ever hope to learn. Each of you understands thoroughly conditions in his own business. Our Bureau spent last year in trying to collect this knowledge from the different groups of business men, and consolidate it in order to discover the general facts pertaining to all the industries in the country, and to ascertain how these facts are related to each other.

> I MAY be unduly optimistic, but I believe that if you will study the business cycle thoroughly until you know the position that you occupy in it at every time, and if you understand the relation of the activities of your own particular business to the cyclical fluctuations of industry in general, you will be able to approach, if not attain, stability in operations from year to year. Knowledge is power, and a thorough realization of the future will prevent you from succumbing to waves of optimism or pessimism as they sweep over the country.

A little more than a year ago, the Bureau was asked by Secretary Hoover to prepare for President Harding's Conference on Unemployment, a statistical report showing the facts concerning cyclical unemployment, and in addition describing the various measures which have been suggested for its relief. Since this investigation fitted in very well with the inquiry already made by the Bureau concerning the income of the people of the United States, and since the Bureau was planning to engage in a study of the business cycle, we were, of course, glad of the opportunity to aid in this work.

My particular part in the investigation was to discover as fully as possible the facts concerning unemployment during the 1921 depression, and to ascertain how labor conditions were affected at that time. The purpose of the President's Conference was to discover remedies for unemployment, hence one would naturally suppose that I would have devoted my first efforts to measuring the extent of unemployment. As a matter of fact, however, it is impossible to measure unemployment unless one is to class as unemployed all persons who are not at work. The common desire is to measure only *voluntary* unemployment, but it is entirely impossible to say how much employment is *voluntary* and how much *involuntary*. An example or two will suffice to verify this statement.

A woman has been working in a mill. She stops work because she needs a rest. She is not sure whether she will return to work later or not. Shall she be classed as unemployed?

A man falls ill. Is he to be called unemployed? Suppose that for five years he continues sick. Is he still one of the unemployed? Suppose that his chief trouble is old age. Do you still class him in the same manner? If not, what age limit will you fix? Will it be the same for the rugged veteran and the feeble weakling? Suppose that a man is able bodied and will work for his usual wage of ten dollars a day but not for eight, is his unemployment voluntary or involuntary? These are typical examples of the problems that must be considered.

A study of these difficulties seems to prove that the only solution is to cut the Gordian knot and measure *changes* in employment. This task in itself is difficult enough. The inquiry which we conducted was designed to answer a number of specific queries about the employment situation.

First, we wanted to know whether or not there really had been much falling off in employment. The fact was pointed out to us that bread lines were not in evidence and that there was little to show much suffering on the part of the working class. Was it not possible, then, that the supposition that there were five million idle men, arose merely from the fact that there had been a great shifting in workers from manufacturing, mining, and transportation into other industries for which no records were available—for example, into

Abstract of paper presented at a meeting of the Taylor Society, Syracuse, N. Y., June 7, 1923.

agriculture and trade? Another way of putting the problem is this: Were the figures at hand showing a decline of employment in the manufacturing industry typical of what was happening in all industries, and did they mark a huge volume of idleness, or were they simply records of a shift of workers from one industrial field to another?

Another question which we sought to answer was whether the decline in the number of employees measured with a fair degree of accuracy the total shrinkage in employment, or whether there was a large additional amount of idleness which arose from placing great numbers of employees upon a part-time basis during the period of dull business.

To secure answers to these queries was by no means an easy task. Numerous lines of attack were tested, some of them with discouraging results, but eventually it was found that by appealing directly to the employers of the country, a sufficient body of information could be obtained to give satisfactory answers to practically every question upon which information was sought. Records were received from employers in all important industries, the reports covering in the aggregate nearly ten per cent of the employees of the United States. When the results thus obtained were tabulated, the following facts were revealed:

Extent of Unemployment in 1921

First, the depression of 1921 did bring about a tremendous decline in employment, for, as a matter of fact, relatively few workers shifted from one industry to another. Falling off in employment was, however, confined mainly to the construction, manufacturing, mining, and transportation industries. In other fields, the depression apparently caused but little change in the total number at work.

About one-seventh of all the workers of the country were idle during the dullest part of 1921. Most of those at work put in full-time, but there was a sufficient number of part-time workers to reduce the total number of employee-hours worked by about one-sixth. When you think of what it means to have one-sixth of the time of all employees in the country lost, you can readily see that the problem dealt with was one of the first magnitude.

The tabulation of the figures led to one discovery which was wholly unexpected—namely, that the tendency to lay off employees was much stronger in large enterprises than in small ones. At the lowest period of the cycle, concerns employing fewer than 21 employees had reduced their total labor force by only 3 per cent, while firms hiring from 21 to 100 employees had lessened the number of hours worked by nearly 14 per cent, and enterprises hiring over 100 employees had cut down their volume of employment by more than 28 per cent. It thus appears that, in the depression of 1921, the man who worked for a large concern was nine times as likely to lose his job as was the man working for a very small enterprise.

Does Business Cycle Accompany Big Business?

This finding is quite the opposite of what many writers have reasoned ought to be the case; in fact it has been freely asserted that with the better organization resulting from the advent of large-scale industry, the stabilization of employment would automatically come about. After seeing these figures, however, we wonder whether the reverse is not true. Since unemployment is the outstanding and all-embracing feature of the business cycle, what characterizes it apparently must characterize the cycle in general. What is the reason that we do not read of frequently recurring depressions, crises, and panics in the history of centuries past? Is it because big business was in those days wholly non-existent? It is possible, of course, that the 1921 depression was abnormal, and that in the depressions of the years to come, it will be the large firms and not the small ones that will give steady work to their helpers. If the 1921 depression followed the normal course, and if the largest enterprises do give the least regular employment, the economic basis underlying this state of affairs is certainly one deserving most careful attention. We must find the answer to this question: Why is the enterprise having fewer than 21 employees able to keep them practically all at work when its larger rival is laying off its workers?

Unfortunately, it is impossible as yet to give a categorical reply to this query. Perhaps the small concern has the advantage because it is in the most intimate contact with the ultimate consumers of its goods. If my hypothesis considering the causes underlying the business cycle is correct, this relationship is presumably one of the greatest moment.

Our Bureau has never formed any theory of the business cycle, hence if I state my analysis of the causes of this phenomenon, you must remember that I am speaking for myself alone, and that my views may be very different from those of the directors of our Bureau, or the other members of the research staff. I shall, nevertheless, enumerate at this point the sequence of events which it seems probable to me characterizes the business cycle.

Just at present, we are near the crest of a typical boom in business. Retailers have found sales good during the past few months. Their profits have been materially enhanced by the fact that the price level has been rising, and hence their wares have tended to grow in value while on the shelves. The increasing cost of goods has so forced itself upon the attention of the retailer that he now feels the necessity of stocking up before prices go higher. As a result, he is buying vigorously and increasing his stocks on hand. The more rapidly he buys the harder it becomes for him to get his orders filled promptly. As deliveries become bad, his natural tendency is to replace orders for more goods than he expects to actually get.

Cause of Buyers' Strikes

This, of course, makes it harder than ever for the manufacturer to keep up with his orders. The manufacturer feels, however, that business is extremely good, and that he can go ahead without fear of difficulty because he has orders on hand. Under these circumstances, he of course puts on as much pressure as possible in an effort to turn out products with maximum speed. This process leads to a snowballing effect. Prices rise more and more rapidly, and it becomes increasingly difficult to get goods. Some day, however, the consumers will conclude that prices are too high, and we shall have buyers' strikes of various kinds similar to the one witnessed recently in the sugar industry. As these buyers' strikes spread, whether silently or with much noise, the retailer will discover that his goods are not moving from his shelves at the rate which he had counted upon. Then he will become panicky, and his natural tendency will be to cancel the orders which he

has already placed. As he cancels orders, the wholesaler and the jobber will necessarily try to follow suit, and the manufacturer will be the one who suffers from the process. Factory prices will collapse, and the manufacturer will find that he is able to sell his finished products for only a fraction of the price that he expected to get for them. Many of the goods which he was manufacturing to fill orders received will remain on his hands. He will be overstocked with raw materials that he bought at high prices. He will have large loans falling due which would have been easy enough to pay off had prices held up, but which it will be next to impossible to meet under the new price conditions.

Strangely enough, during all this time, retail prices will still be holding up to relatively high levels, for the retailer's custom is to sell his goods at a certain percentage over cost price with little regard to current price at wholesale. This tendency for retail prices to remain high after factory prices have fallen sharply has long deceived economists, and has led them to believe that the force causing the decline in prices must originate in the factory. As a matter of fact, the truth seems to be that *the initial impetus comes from the consumer* when he fails to buy the expected quantity of goods from the retailer.

Once factory prices have reached bottom, there ensues a considerable period of liquidation characterized by many failures and large amounts of "frozen credit" at the banks. During this period, retail prices steadily fall, retail purchases are extremely low, but the physical volume of sales by retailers remains at a relatively high level. This fact is one of the interesting things brought out by the recent investigations made by the Federal Reserve banks. Their studies show that during both good times and bad, the total dollar value of sales of retail stores tends to remain approximately a fixed quantity. This being true, it necessarily follows that as retail prices fall, the physical volume of sales must grow larger.

Retailers Again Enter Market

Since, during the depression, retailers buy little and sell much, their stocks eventually must become depleted, and a time will arrive when they will be compelled again to enter the market for goods. The wholesalers will pass the orders along to the jobbers and manufacturers, soon the factories will again be humming, and business will once more resume its upward course. In about three and one-half years from the crest of the first boom, we shall not only have passed down into the trough, but shall have again climbed the next hill to the top.

So much for the way the cycle works. What are its chief effects? When the depression hits the factory, and the prices of finished products fall, it becomes imperative for the manufacturer to reduce costs if he is to keep his plant in operation. Wage earners, of course, do not take kindly to wage cuts; hence the usual solution is to lay off a large percentage of the working force, and to put some of the other employees upon part time. During the 1921 depression, this process continued until it reduced the total volume of factory employment by 30 per cent and, in factories turning out metals and metal products, the reduction was slightly over one-half. Now when the manufacturer lays off his workers he reduces his expenses, but he still loses money because of his overhead costs. To compensate him for this loss, he usually has large profits piled up during the boom. But how about the employee? When he is out of a job, his expenses are not reduced, but his income is entirely cut off. Furthermore, his gains from larger wages during the boom period were as a rule proportionately less than were the extra profits of his employer.

Profit-Sharing Not Advantageous to Employee

As you understand, our Bureau takes no position on any policy, and I can speak for no one but myself, but I am one of those who believe that the idea of profit-sharing is entirely contrary to the interests of the employee. It seems to me that the employer is the one who should bear the brunt of the depression, and that he should therefore be entitled to the gains acquired during the boom. I see no prospect of gain and every prospect of loss if the workers obtain a controlling voice in the direction of industry; but if you agree with me in these ideas, I hope that you will also agree with me that the worker has a legitimate right to demand that a system shall be worked out which will enable him to be employed steadily as long as he renders satisfactory service. Whiting Williams, who recently spent much time among the ordinary laboring classes, studying their psychology, shows that *the thing which they most want is a guarantee of a steady job.* Regular work at steady wages, even though the wages are not as high as are now paid in boom times, seems to me the best insurance against Bolshevistic tendencies among the working classes.

To my mind, then, it is the duty of all good citizens to co-operate in furthering to as great an extent as possible the idea of making employment stable from month to month, and from year to year. The employer will, in the long run, gain as much as anyone by such a stabilization, and he occupies a strategic position which he should utilize to the best of his ability to bring about this desired end.

Sound economic policy does not demand that we give men unemployment insurance while they stand idle and produce nothing, does not ask that we transfer them from their homes to do goverment work in some out-of-the-way locality, but rather that we keep them steadily engaged at their regular tasks. The employer, however, can hire men only when he has work to be done. His problem, then, is that of stabilizing his output. He must prepare not only for the short year of twelve months, but also for the long year of the business cycle, a year which averages some forty months in length. Is there any practical way of attaining such an end?

As I said at the beginning, I am far from posing as an expert in the manufacturing field, but I wish to make certain suggestions which I believe many of you may be able to apply with modifications to your own specific enterprises.

Be Conservative During Booms

It seems to me that now during the boom is the time to be conservative. Raise wages as little as possible, thus avoiding the necessity of severe wage cuts at a later date; adopt a hand-to-mouth policy in buying raw materials; scrutinize carefully all orders from your customers; go slow in accepting orders from men whose credit is not of the best; see that all contracts are definite so that the chance for cancellation is reduced to a minimum; postpone building those additions to your plant which seem so necessary; reduce your stocks of finished products to a minimum; and, above all—

accumulate cash. Sell all but the most gilt-edged securities; dispose of any unnecessary assets; and strengthen your cash position at all costs!

I realize that most of you will say that this is the impractical advice of a theorist; that you will lose customers, that you will sacrifice your chances for profits; and I will agree that these things will happen—but I am not sure that two years from now the advice will seem as visionary as it does today.

Many optimists tell us that business has now reached a high plane, and that you may look for it to remain on this level for several years to come. I fear that they merely typify those happy-go-lucky people who sing and dance during the summer, forgetting the long winter ahead. The chances are that by late 1924 or early 1925 business will again be very dull, orders few, and prices discouragingly low. Now is the time to plan for the depression ahead, for if you do not plan now, you will not be ready for it when it comes. Study the statistics of your own business to see what the long time trends are, and plan now the buildings which you will need, the new machinery which you will require to take care of the normal growth of your enterprises. Arrange to construct these during the depression when labor and material costs are low. Remember that after the depression will come another boom, and that, during this next boom, you will again have difficulty in making goods fast enough to fill orders as they come in. Plan now to make goods for stock during the lean months while materials are cheap. Arrange also a campaign for securing orders well in advance. If you go into a depression with small stocks on hand, you will not find that the accumulation of stock manufactured during the dull times will so greatly overload your warehouses. With an abundance of ready cash on hand—the cash which you have saved during the boom—you will be able to take advantage of bargain prices in materials. A few manufacturers have demonstrated that by such careful long-time planning, and by conservative action during the boom, they are able to guarantee steady work to all their employees who care to remain on the job. If you have not raised wages much during the boom, you will not need to cut wages much when hard times appear. If during the dull times you have manufactured quantities of goods for stock, it will not be necessary to hire many additional workers for the next boom, and hence you will have little occasion to pay fancy wages in order to fill your orders.

I may be unduly optimistic, but I believe that if you will study the business cycle thoroughly until you know the position that you occupy in it at every time, and if you understand the relation of the activities of your own particular business to the cyclical fluctuations of industry in general, you will be able to approach, if not attain, stability in operations from year to year. Knowledge is power, and a thorough realization of the future will prevent you from succumbing to waves of optimism or pessimism as they sweep over the country.

The idea of stabilization appears to me to be a practical application of the Golden Rule, and one which will in the long run not only bring prosperity and contentment to your employees, but will also make your enterprise a safer investment for bondholders and stockholders as well.

Carrying Industrial Safety Into the Community

By R. G. Adair

Safety Engineer, The American Rolling Mill Co.

Community safety is the logical outgrowth of industrial safety. In the plants of the American Rolling Mill Co. we have been teaching safety for years. We begin the very day a man is hired.

Before he is permitted to pass through the gates to his job, we give him a safety talk and impress upon him the importance—first, of his personal responsibility to himself, second, his family, and third his fellow workman. It is only human for a man to be primarily interested in his welfare, and this self-interest gives us our starting point. We try to drive home the fact that every workman owes it to himself and to his company to keep from becoming physically incapacitated. We dwell upon the fact that it is only by working regularly that he will be able to give his family the greatest measure of protection. Finally, we try to get every man to feel his full responsibility toward the protection of his fellow workman.

Thus, also, we point out specific hazards of the iron and steel business with which he will come in contact, regardless of the job to which he is assigned; overhead electric traveling cranes, electricity, railroad yards, etc. We even tell the workman about the kind of clothes he should wear to protect himself against injury and discomfort.

At this first lesson every man is told emphatically the company's point of view in regard to the importance of safety. It is this: No job in the plant is so important that a man need take any chance of becoming injured in carrying out the work. That, in a word, is the company's policy.

Special Hazards Emphasized

After this introductory talk on safety, the man is turned over to his foreman who points out to him the specific hazards of the job. It might seem that this is enough to establish firmly in the mind of every workman the importance of safety, but we dare not stop here. More work must be done before we can obtain our ideal which is to establish in every mind a deep seated consciousness of the importance of safety.

We begin to teach a man safety the very first day he goes to work for us, but we believe that the greatest opportunity to teach safety comes when a man is off the job, when his mind is unburdened with the details of his work. It is then that he is more receptive. He is more or less free for 16 hours of the 24 and he will absord more of the things we want him to know about safety. During the leisure hours we believe we can build up a lasting consciousness in the mind of the workman; and this is by far the most desirable and effective safeguard known. When a safety consciousness is really established, then we get safety in the community as well as in the industrial plant and it is a most important factor in both.

And it is in this community safety that we are especially interested just now. To this end we have safety taught in the public schools in Middletown. Think what this will mean to Middletown industry when these young men and women enter our industrial life and activities.

Extract of paper presented at the National Conference of Business Editors at Middletown, Ohio.

Progress in Gear Standardization

Résumé of work accomplished by the Sub-Committees of the American Gear Manufacturers' Association since October, 1922

THE Spur Gear Committee has been working on rules for the strength of gears as well as a spur gear nomenclature. Each chairman of a committee is a member of the Nomenclature Committee and each committee feels itself called upon to develop a nomenclature to suit its own needs.

The Bevel Gear Committee has added to its previous recommendations a "Suggested Standard for Future Design for Bevel Pinions of Ten Teeth or Less" and a nomenclature for bevel gears covering almost every item in practical use.

The nomenclature of the bevel gear committee, together with that of the spur gear committee and with that otherwise submitted to the sectional committee has permitted the sectional committee to give this matter a great deal of attention. Some 60 definitions that have been accepted by the sectional committee are being printed and will be distributed to the members of the A.G.M.A. in the very near future for their consideration and for them to act upon at the next meeting, which will be held this Fall.

The Worm Gear Committee has worked up a recommended practice for the proportions of worms and worm wheels for single, double, triple and quadruple threaded worms where the worm would have a hole and the face of the wheel would be the maximum for most efficient service.

It also offers rules for calculating the proportions for wheels for existing hobs.

These recommendations should fill a useful place in gear design and be of great help to every user of worm gears.

The Sprocket Committee has worked in close conjunction with the Committee of the A.S.M.E. and the S.A.E. in developing a standard for roller chains and at the last meeting in April, presented quite an extensive progress report. It seems probable that within a short time a roller chain standard will be adopted which will cover all items connected with the design and use of roller chains.

The Inspection Committee has been steadily considering the possibility of finding some means of inspecting gears for noise, or rather trying to find some means for the measurement of gear noises.

The Metallurgical Committee presented at the April meeting quite an extensive progress report, consisting of recommendations for the heat-treatment of the various gear steels together with photo-micrographs. The committee also made a recommendation for the testing of steels by the spark test. At the Fall meeting it is probable that this progress report will have been printed and submitted to the Association to be acted upon as recommended practice.

The Herring-Bone Gear Committee has had under consideration for the last six months a recommended practice for using standard spur gear hobs for the cutting of herring-bone gears. Such practice should be a great help to anyone who has hobbing machines and hobs as used for spur helical gears, because it will enable him to cut herring-bone gears to a standard commonly known to all gear users.

The Committee on Electric Railway Gear Pinions has been working during the last six months in smoothing out its recommended practice and also has been working in connection with determining specifications for a standard forged steel blank for electric railway service.

The Keyway Committee has been able only to report progress, but it has been in close touch with the A.S.M.E. committee on shafting.

The Differential Committee has been in close touch with the S.A.E. committee and has offered a nomenclature. The work of this committee is such that progress can be made only as the committee works in co-operation with the S.A.E. and it is, of course, doing so.

The Tooth Form Committee has been considering a standard stub tooth but up to this time has made no recommendation.

Prepared by B. F. Waterman, of the Brown & Sharpe Mfg. Co., Chairman of the General Standardization Committee, at the request of the *American Machinist*.

Cold Working of Copper

The last bulletin of the Bureau of Standards contained mention of the work of the bureau on the scratch hardness of copper which has led to some interesting results regarding the effect of cold working of this material. As was stated in this item, the effect of cold deformation is first to harden the metal. As the deformation continues, the metal softens as measured by the scratch hardness and by the micro-Brinell methods.

During the past month the effect of annealing on such worked specimens has been considered. Low-temperature annealing, that is, at 100 deg. C., softens all worked specimens somewhat, but the general form of the hardness curve is still preserved. After annealing at a higher temperature all specimens showed the same hardness, thus indicating that thinness of the rolled material does not affect materially the results of the scratch hardness test.

This is an important point and suggests the use of this method of hardness testing on such specimens as are too thin to permit the determination of hardness by other more familiar methods. The results obtained with pure iron and with an iron-carbon alloy (low-carbon) were of the same general character.

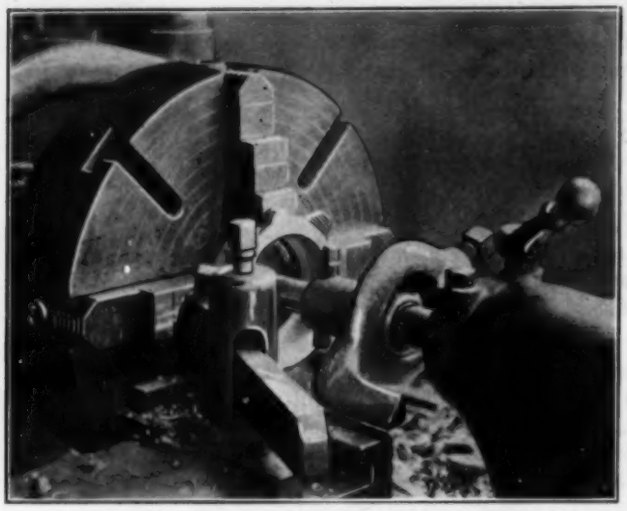
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Tailstock Boring Tool

BY ROBERT BRAINARD

The boring tool illustrated herewith can be used for taking heavy cuts, or as a sizing tool. The body of the tool has a taper shank on one end to fit the tailstock spindle and a pilot on the opposite end. A square hole and a setscrew provide means for inserting and holding a toolbit. A bushing fitting the hole in the center of the lathe chuck serves to guide the pilot. The tool is prevented from turning by a lathe dog clamped on the



A TAILSTOCK BORING TOOL

body and allowing the tail to rest on the tool block. With this tool we took cuts of ¼ in. in malleable-iron castings, holding the dimension within a limit of 0.003 in. This job was in the shop of the Pearson-Scott Co., Indianapolis, Indiana.

Grinding, Boring or Reaming Cylinders

BY WM. R. SEDDON

Some motor car owners and shop men still have their doubts as to which method of cylinder refinishing is best. They still seem to fear that grinding leaves abrasive materials in the pores of the cast iron and that it constantly cuts the cylinder wall and piston.

Boring, however, has this disadvantage; if you strike a hard spot in the cylinder wall, which is a very common occurrence, the tool will leave a high spot. The reamer makes a fairly nice job, but if the hole was not square with the base of the cylinder in the first place, it will not be square after it is reamed, for the reamer is bound to follow the old hole.

Grinding, it seems to me, has eliminated all of these troubles, for the hard spots can be ground out and, when the cylinder is finished, it is always square with the base, regardless of how crooked it was before. Grinding can also be done more quickly and at less expense to the car owner. There is less friction on the cylinder walls and we have found that if the grinding is properly done and the motor carefully assembled, ground cylinders are good for 8,000 more miles than a rebored job.

There is still another way to look at it. If grinding was not the better method, makers of high grade cars would not install expensive cylinder-grinding machines for finishing the cylinders, for they are all bored first from the rough casting.

A Self-Clamping Vise for the Hand Milling-Machine

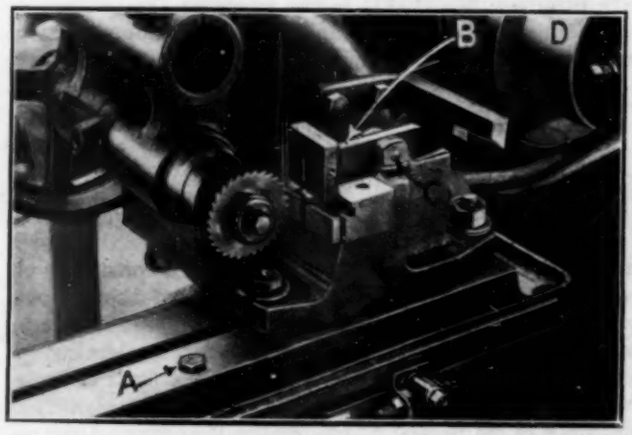
BY MILTON WRIGHT

Having a large number of the small dies, shown at *A* in the illustration, to be sawed open through one side, the self-clamping vise was rigged up on the table of the hand milling-machine to expedite the operation of sawing.

The upper clamping jaw is on the end of the lever *B*, which is fulcrumed at *C*. A heavy coil spring under the rear end of the lever serves to hold the jaw in closed position and exerts ample pressure to keep the die from moving when the saw comes into action.

The stationary bracket *D*, made from a piece of cold-drawn steel of rectangular section, is attached to the head of the milling machine. When the operator moves the table back by raising the hand-feed lever, the beveled end of the vise lever *B* passes under the stationary bracket *D*, thus further compressing the spring and releasing the hold upon the work. Changing the work piece, the operator brings it forward to the saw and as soon as the end of the vise lever passes clear of the bracket the pressure of the spring again comes upon the work.

By means of this simple and easily rigged device the operator is relieved of the burden of opening and closing the vise each time and can proceed with the work as rapidly as if no clamping were necessary.



SELF-ACTING VISE FOR THE HAND MILLING-MACHINE

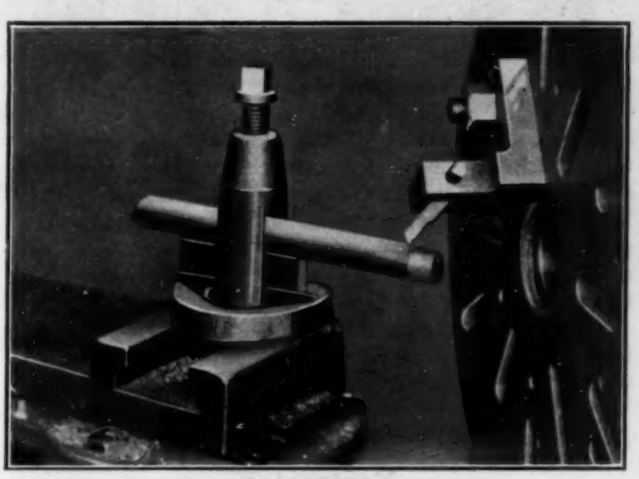
Turning Ovals

By V. Nelson

For turning an oval in the lathe the tool may be mounted on the face plate of the lathe and the work to be turned clamped in the toolpost parallel with the slide of the compound rest, as shown in the illustration. The proportions of the oval are determined by the angle to which the compound rest is set, the greater the angle from the center line of the spindle, the greater the difference between the length and width of the oval.

The angle to set the compound rest for an oval of any desired proportions can be determined by the following formula: Length ÷ Width = secant of angle.

The oval being turned, as shown in the illustration,



TURNING AN OVAL IN A LATHE

is ½x¾ in. and the secant of the angle is found as follows: ¾ ÷ ½ = 1.5. Referring to the table of secants we find that 1.4998 (the nearest to 1.5) is the secant of 48 deg. 11 min. which is the proper angle for setting the compound rest.

This same principle can be used on a milling machine having a dividing head that can be tilted to the desired angle.

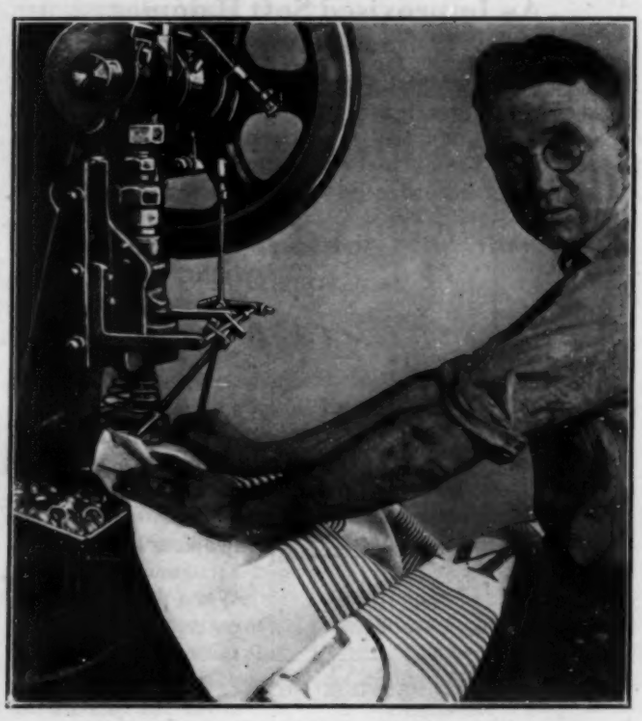
Spring Safety-Device for a Punch Press

By N. C. McLoud

The accompanying illustration shows a safety device invented by A. E. Wilde, an employee of the Mail Equipment Shops of the Post Office Department. The special function of the invention is to save human fingers. The device takes the form of a guard for the punch presses which are used in grommeting mail bags in the process of manufacture.

The Mail Equipment Shops turn out millions of these bags during the course of the year and the harvest of fingers has been a serious problem. During a period of two years ending June 30, 1922, thirty-one operators lost fingers in the operation of the presses. After Wilde's guard was adopted and installed, in July, 1922, but two accidents of this nature occurred in a period of ten months.

The guard is a spiral spring surrounding the punch. In the downward stroke of the punch the guard moves in advance, and a hand left too long in the path of the stroke, receives a warning blow from the spring. The yielding pressure enables the operator to withdraw his



SPRING SAFETY-DEVICE ATTACHED TO A GROMMETING PRESS

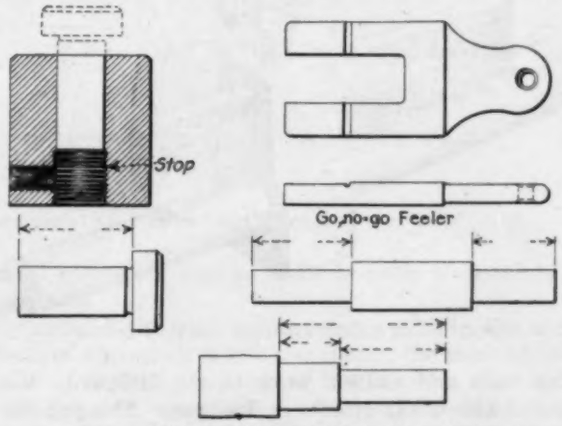
hand in time to prevent an accident. Without the spiral guard there would be imminent danger of having a finger chopped off. The Post Office Department has paid Wilde a special award of $100 for the improvement, out of money derived from a fund set aside by congress for recognition of specially notable services.

Gaging Under-Shoulder Lengths

By T. P. Schustek

Here is a new stunt in the gage line for checking the length of studs, shafts, etc. from under a shoulder to the end, or from shoulder to shoulder.

By making the gage block heavy enough to set on the



GAGE FOR UNDER SHOULDER LENGTH

bench and by pressing down on the work to hold it securely against the stop, the work can be gaged very accurately with the go, no-go feeler.

This gage with variations can be used for a great variety of work, some examples of which are shown in the sketch herewith.

An Improvised Soft Hammer

By John Aures

Very few machinists who are sent out to do repair work care to lug a brass or copper hammer with them on account of the extra weight and space it takes up in the tool kit. Yet at times a tool of this kind is almost indispensable in order to prevent work from being marred, or to protect the worker from injury when striking hardened steel.

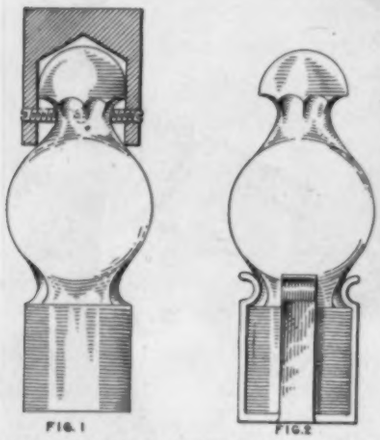


FIG. 1 FIG. 2

FIGS. 1 AND 2—IMPROVISED SOFT HAMMERS

So as to always have a soft hammer with me, I made a sort of hood out of brass to fit over the ball peen of my hammer, holding it in place with four head'ess set screws as shown in Fig. 1. When traveling extra light, I take instead, a hood made of spring brass to cover the face of the hammer. This hood, shown in Fig. 2, has four clips which snap into the neck on the head of the hammer. The whole thing is made out of a single piece of brass. Both these devices will give perfect satisfaction.

Two Ways of Straightening Shafts in a Lathe

By Franck C. Hudson

Here are two methods of straightening a bent shaft or rod in a lathe, without damaging the centers or the spindle. In fact the lathe is simply used as a convenient place for holding the shaft while straightening.

The method shown in Fig. 1 is used for straightening

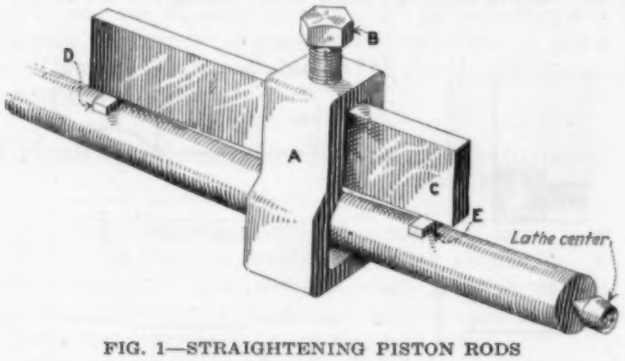


FIG. 1—STRAIGHTENING PISTON RODS

piston rods and similar work in the Hillyard, Wash., shops of the Great Northern Railway. The yoke *A* is forged to about the shape shown and provided with a heavy screw at *B*. The bar *C*, which is perhaps 1½x6 in. and 30 in. long, slips through the narrow, upper portion of the yoke, which prevents it from turning sidewise.

The yoke *A* is slipped over the piston rod as shown, the bar *C* put in place and steel blocks *D* and *E* put under the ends of the bar, or wherever needed to remove the kink or bend. Bars of various lengths can also be provided to suit different kinds of work. This device as will be seen, is self-contained and puts no strain on the lathe in any way.

The method shown in Fig. 2 was found in the shop of the Pekrul Iron Works, Denver, Colo. and may be

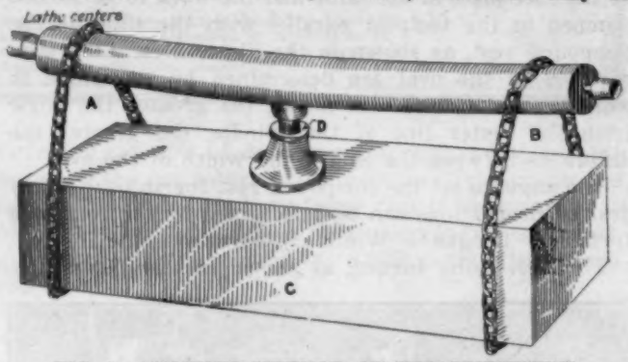


FIG. 2—ANOTHER METHOD OF STRAIGHTENING

said to be the reverse of the first method. The shaft is placed in the lathe as a convenience only. The heavy chains *A* and *B* are used to sling up the timber *C*, which is 8 or 9 in. square and 36 to 40 in. long. The jack *D*, placed under the low part of the bend, is used to force up the center while the chains take the stress due to the pressure applied.

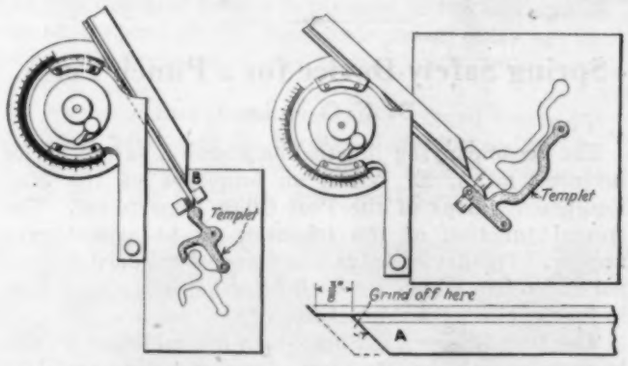
The chain method can be applied to a variety of cases while the other is more or less confined to one class of work.

Laying Out Dies with Templet and Protractor

By John C. Alhquist

The accompanying illustration shows a method I have used for laying out dies from a templet by the use of a protractor, which method eliminates the necessity for sweating or otherwise holding the templet on the die block.

To use this scheme, the blade of the protractor should be ground off as shown at *A* and the templet attached



LAYING OUT DIE WITH TEMPLET AND PROTRACTOR

to it by means of a small parallel clamp. The templet may then be held at any desired angle on the die by setting the protractor accordingly. To get the leads, the protractor has only to slide along the edge of the die.

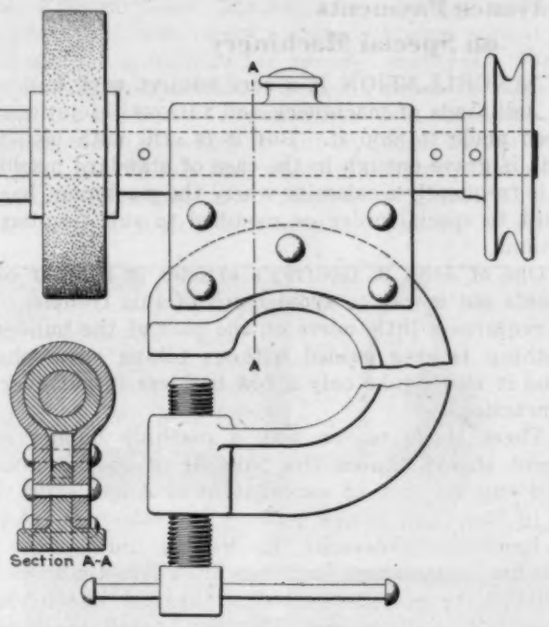
If the templet does not happen to have two parallel surfaces on which to put the clamp, a projection can be left, as at *B*, when the templet is made. If the projection is not wanted for any other use, it can be filed off after it has served its purpose.

A Simple Grinding Attachment

By Geo. A. Luers

The uses for the grinding fixture shown in the sketch herewith are almost limitless. It can be attached to a bench, lathe, drilling machine or sewing machine. The drive can be through a treadle, as on the sewing machine, from a bicycle wheel or any kind of a motor.

The construction involves only materials that are normally available, of which the C-clamp, forming the base



SIMPLE GRINDING ATTACHMENT

and bracket, is the main part and makes the grinder readily attachable to any projecting surface.

The bearing for the spindle is a short section of brass pipe, and is secured to the clamp with a riveted strap as indicated.

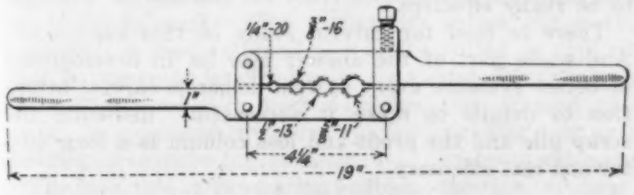
The spindle is a short length of cold-rolled steel having a thread at one end for the grinding wheel and a pulley at the opposite end. With the simplest of materials a most useful and inexpensive grinding attachment is provided.

An Old Time Threading Die

By H. M. Darling

While on a recent hunting trip among the Blue Mountains in Pennsylvania, some of our party ran across an abandoned blacksmith shop which had apparently been closed for a good many years.

The blacksmith must have been a real mechanic in his day, as the shop was fitted with a number of ingenious home-made tools which showed considerable skill in their making. Among others was the die illustrated



AN OLD THREADING DIE

herewith, which I thought might be of interest to *American Machinist* readers.

The die was arranged to cut four sizes and consisted of two pieces of steel hinged together and adjusted by the screw shown. This tool looks rather crude in comparison with some modern adjustable dies, but no doubt it served its purpose in the days in which it was used.

Trepanning Tool for Flue Sheets—Discussion

By R. E. D. Delrue
Steyr, Austria

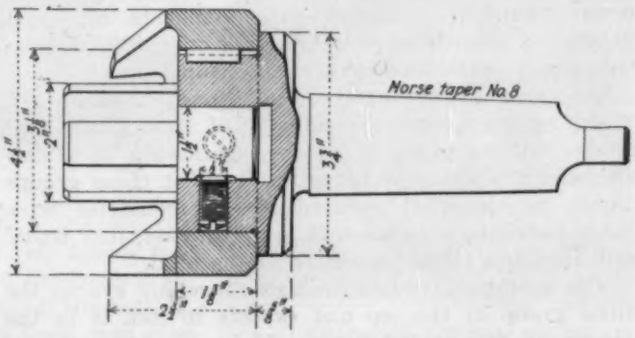
The trepanning tool shown by Louis E. Reibel in an article under the above heading, published on page 969, Vol. 57, of the *American Machinist*, invites criticism.

In the first place the whole tool except the pilot is made from a single piece of tool steel and therefore involves an unnecessary expense for material. Further, if a single tooth is broken the whole tool is reduced to scrap and must be replaced. If there are a large number of holes to be made there must be a lot of tools on hand in order to avoid interruption of the work by reason of such breakage.

I would suggest that the tool be made as in the sketch accompanying this article. At first glance it may seem more complicated and expensive than the design offered by Mr. Reibel, but upon careful consideration I find the following points in its favor:

The shank can be made of machine steel and there need be but two of them, one in service while the other is in the tool crib for regrinding, thus saving a considerable quantity of expensive material necessary in the tool described by Mr. Reibel.

By using a special boring tool in making the cutters the center of each cutter can be cut out, thereby leaving in each case a piece of tool steel 2½ in. in diameter and of a length equal to that of the cutter. A sufficient



AN IMPROVED TREPANNING TOOL

number of cutters may be made to cover all possible requirements.

By making the pilot a light driving fit in the shank instead of threading it into the cutter, the work of refitting it in case of breakage of the latter is eliminated, and it is much more easily removed, especially if the pilot itself should be broken. One or more setscrews serve to hold it against the strain of cutting.

Extra cutters, only, need be made, as the shanks may be used indefinitely and for any number of sizes within a reasonable range. A keyway, partly in the shank and partly in the cutter, accommodates a key to do the driving.

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Editors

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The Field for Engineering Graduates

OF LATE YEARS we have often heard the statement that the technical schools and universities of the country are turning out too many engineering graduates. The inference has been that the supply greatly exceeded the demand and that the engineer would soon find himself in the same boat as the lawyer. We have no figures at hand, but we have been informed that the number of unnecessary lawyers in a city like New York is appalling. Certainly there are plenty of lawyers in legislative circles whose services could easily be spared if they were to turn to some more productive endeavor.

But what of the engineering graduate? What are his prospects? Who needs him?

For our purpose it will be sufficient to consider mechanical engineers only, as they are the ones most useful to the machinery industry. Some little time ago a joint committee representing the National Industrial Conference Board and the Society for the Promotion of Engineering Education began the study of engineering education and its connection with industry. The committee is nowhere near the end of its work, but it has developed some interesting figures.

In studying the field for technical graduates the possible jobs for them were divided something like this: At the bottom of a step pyramid is a great group of several hundred thousand superintendents of small plants and general foremen of larger ones. Next above this group is a smaller group of superintendents of large plants and managers of small ones. Then comes a still smaller group of managers of large plants and finally, at the pinnacle, a select gathering of a few thousand "captains of industry." All of these groups would be somewhat reduced if the industries were limited strictly to metal-working. However, they would still include a large proportion of the total.

The average graduate promptly fixes his eye on the little group at the top and expects to join it in the course of five or ten years. If he is of exceptional ability he may succeed, but he can hardly be considered a failure if he does not. Industry is eager for technically trained men to fill the vast number of executive positions down the line, and the graduate may expect a cordial welcome if he is not too anxious to run the whole show immediately.

As a matter of fact the technical schools graduate every year less than a tenth of the number of men needed by industry to start in the minor executive jobs and work up. These jobs are filled by the fellows trained in the school of experience and hard knocks, and usually well filled, too. But the struggle upward is becoming steadily more difficult for the man not fortunate enough to have the benefit of special training as the complexities of industry multiply.

We have not the slightest intention of disparaging the men who have worked their way up from the ranks. They usually win less than they deserve. But we do want to emphasize the real opportunity for technically trained men in industry and set at rest the old theory that there are too many engineering schools.

Advance Payments on Special Machinery

CANCELLATION is a sore subject with builders of all kinds of machinery and various resolutions have been made to stop it. But it is still with us. While this is grave enough in the case of standard machinery, it is frequently a calamity where the machinery has been built to special order or modified to suit peculiar conditions.

One of John R. Godfrey's articles in another column points out a way to avoid much of this trouble. True, it requires a little nerve on the part of the builder, but nothing is ever gained without taking some chances. And it would take only a few builders to put over such a practice.

There is no reason why a machine builder or his agent should finance the building of special machines and run the risk of cancellation or a law suit. There is in fact, little choice between the two evils. Advance payments on orders of this kind would tend to force the use of standard machines or, where these were not suitable, to protect the builder against loss by having them left on his hands. The plan is well worth careful consideration as it is perfectly fair and reasonable from every point of view.

The Cost of Mistakes

A PROMINENT and successful manufacturer recently stated his belief that the greatest problem confronting managers and executives of all kinds was the elimination of easily avoidable mistakes. He has no delusion as to the securing of perfection in everyone or anyone, but he believes that ways and means can be found to eliminate much of the waste which is directly traceable to errors which can be avoided with a little care and training.

"If," he said, "we could eliminate the mistakes in this plant, we could all work but four hours and earn just as much as we do now." In his opinion mistake preventing methods can do as much as labor saving machinery.

The word mistakes in this case does not refer to errors of judgment, but to the forgetting to order materials, errors in copying figures, being too dependent on a memory which is not dependable, and taking things for granted. It is a problem of training, not of punishments, and should start in the Kindergarten if it is to be really effective.

There is food for careful study in this suggestion. And while part of the answer may lie in development of better systems, every system demands careful attention to details to make it successful. Reducing the scrap pile and the profit and loss column is a long step toward real efficiency.

Shop Equipment News

Fellows Thread Generator

The Fellows Gear Shaper Co., Springfield, Vt., has recently placed on the market a machine for generating threads such as those used on taps, worms and hobs. This machine, the front view of which is shown in Fig. 1, works on the molding-generating principle, and uses a helical cutter such as is employed on a gear shaper. The principle of operation of the machine can best be understood if the threads are considered as rack teeth which are wrapped around a cylinder in a helical path.

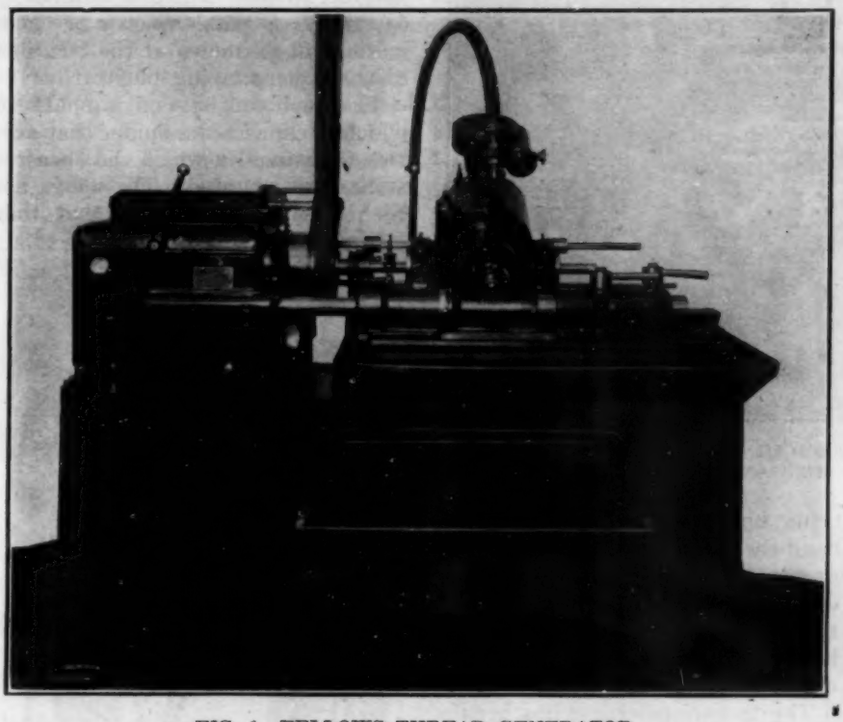


FIG. 1—FELLOWS THREAD GENERATOR

In generating the threads, the work rotates on an axis at right angles to the axis of the cutter. The cutter also rotates in harmony with the work; that is, the two are geared together in relation to the number of teeth in each. The cutter is carried in a head retained in a slide that is traversed longitudinally. As the cutter is rolled in mesh with the work, it produces threads by the molding or generating process.

The principle of generation enables the cutter, illustrated in Fig. 2, to be operated at a high rate of speed, and brings with it several important advantages. First, as the cutter is rolled in mesh with the work, any one particular portion of the cutting edge on the tool remains in contact with the work for a very short period of time. Second, this rolling action enables the cutting tool to take what might be known as a shaving cut, so that a comparatively coarse feed can be given. Third, one tooth is not depended upon to do all the cutting, but there are many teeth, and they are brought successively and at a rapid rate into contact with the work.

The operation of the thread generating cutter is somewhat analagous to that obtained when using a circular cutting tool in a lathe, and rotating it rapidly as it is being traversed across the work. The gear shaper cutter, as applied in this manner, has one advantage in that the cutting tool, instead of being a continuous circular cutting edge, is interrupted by tooth spaces preventing the transmission of heat completely around the cylinder. These tooth spaces also fulfil the same function as a chip breaker, and prevent chip wedging. A still further distinction between these two types of cutting tools is that with a circular rotary cutting tool, the action of cutting is closely analagous to turning. With the gear shaper cutter, it is turning and milling combined.

As an illustration, assume that a triple-threaded worm is being generated, which is 2.100 in. in diameter, and that the worm can be rotated at a speed of 600 r.p.m. If the cutter used has a pitch diameter of 3½ in. and the linear pitch is 0.525 in., it would have 21 teeth, and would rotate at a speed of 57.14 r.p.m. At a work speed of 600 r.p.m., the cutter would be operating at 330 ft. per minute at the outside circumference of the work. Each tooth of the cutter would remain in contact with the work for approximately 1/20 sec., and 1,200 cutting teeth would be presented to the work every minute. Comparing these speeds with those used in milling and turning with tools made from high-speed steel, it will be seen that speeds ranging all the way from three to five times as great can be employed in this particular process, bringing with them a consequently greater increase in production.

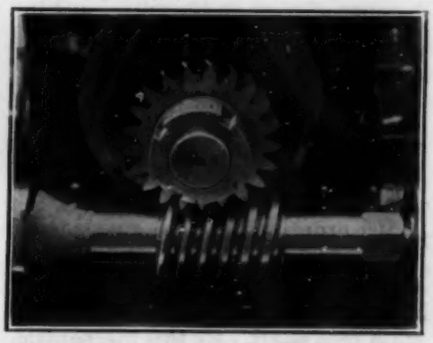


FIG. 2—FELLOWS THREAD GENERATING CUTTER

Certain conditions must be met in a machine for generating threads. The revolving cutter must be kept in proper step with the revolving work; arrangement must be made for traversing the cutter longitudinally along the work, and for properly controlling the rotative

speed of the cutter when the translating motion is taking place. As an illustration, if a generating cutter were geared up with a worm thread, the cutter would run satisfactorily with the thread provided that it were not moved longitudinally. As soon as the cutter were moved longitudinally, however, it would cut off the threads of the work, unless some provision were made for varying the cutter speed to suit the translating motion of the cutter.

Change gears are provided for taking care of the ratio between the number of teeth in the cutter and the threads of the work, and change gears are also used for traversing the cutter along the work at a certain feed per revolution of the latter. Change gears and the differential mechanism take care of the translating motion of the cutter.

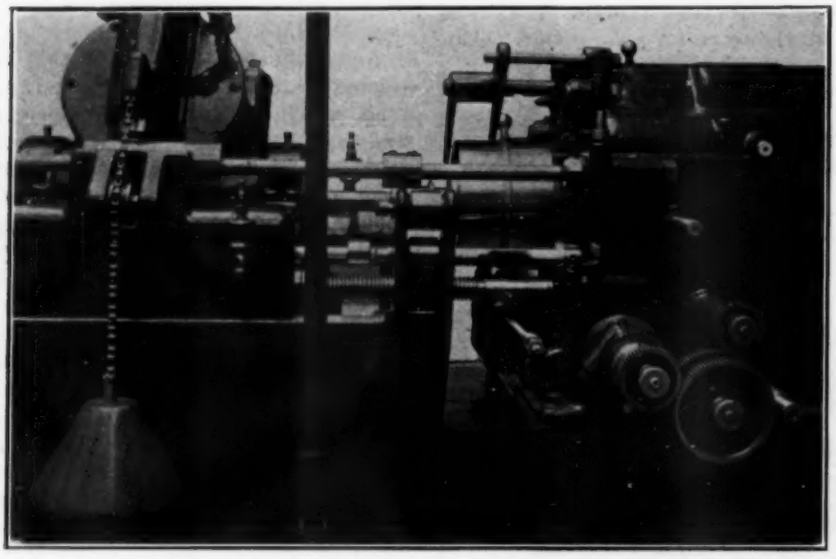


FIG. 3—REAR VIEW OF FELLOWS MACHINE, SHOWING DRIVING AND TRIPPING MECHANISM

In order that the cutter-slide, which is operated by a lead screw, can be traversed in both directions, a reversing clutch is used on the main feed shaft. By this mechanism, it is possible to traverse the cutter over the work; then, as the cutter goes out of contact with the work, the tripping mechanism, shown in Fig. 3 together with the driving mechanism, operates to stop the machine. In cases where the work can be finished in one cut, the cutter traverses from right to left; and when it goes out of contact with the work, the latter is removed, another piece inserted, and the reversing clutch shifted, so that the cutter traverses from left to right, thus obviating the necessity of returning the cutter-slide at the completion of each cut and starting at the same end.

The head that holds the cutter is provided with trunnions which are retained in suitable bearings in the cutter-slide, so that the head can swivel and thus elevate or lower the cutter with relation to the work. The control of this head is through a depth control bar which is supported in a seat in a projection on the cutter-slide. Resting on this bar is a shoe or roll, as requirements may demand, which is held in a rod that passes up through the head and is threaded into a wormwheel, the latter being operated through a worm and handwheel for setting the cutter to proper depth. The depth control bar can be made in various shapes so that roughing and finishing cuts can be taken, or it can be made plain and only one cut taken.

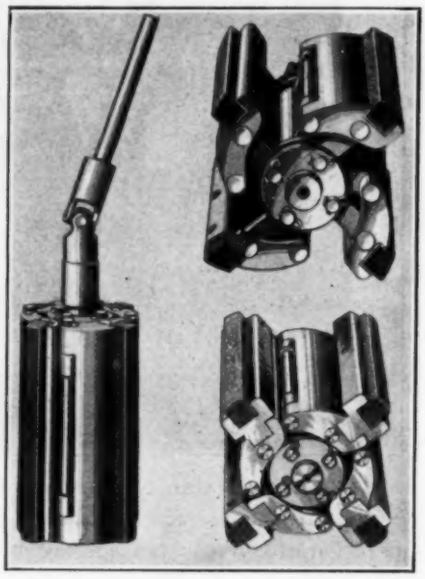
The thread generator has been so designed that it is capable of handling a large range of work. The maximum capacities of the No. 1 machine here shown are: A length of thread of 12 in., a center distance of 18 in., a pitch of $\frac{3}{8}$ in. linear or 5 diametral, a helix angle of 23 deg., a pressure angle of 14½ deg., and an outside diameter of 23 degrees.

When provided with standard equipment, the machine will cut single, double, triple and quadruple threads of $\frac{1}{4}$ in. linear pitch, or 6 mm., up to $\frac{3}{8}$ in. linear pitch, or 16 mm., inclusive. By the use of a special worm and wormwheel in the cutter head, which may be substituted for the standard type, single threads from 1/20 in. linear pitch, or 2 mm., up to and including $\frac{1}{4}$ in. linear pitch, or 6 mm., may be cut.

Ammco Centrimatic Cylinder Hone

A cylinder honing tool that is so constructed that the faces of the hones are all held at the same distance from the center of the spindle has been developed by the Automotive Maintenance Machinery Co., 549 W. Washington Blvd., Chicago, Ill. The tool is expanded by centrifugal force and the stones are connected so that all are expanded at the same time and to the same extent. This method of construction insures the exertion of equal pressures on the stones; it is said that high spots are quickly removed and that the use of the hone in a worn cylinder bore will produce a round, straight hole. The tool, which is ordinarily driven by a portable electric or pneumatic drill, is shown at the left side of the accompanying illustration.

The tool consists of a shaft to which is connected a spider that carries the wings in which the abrasive stones are mounted. The wings are hinged at both ends, so that they are always maintained parallel to each other and to the axis of the tool, regardless of the distance from the center. Each stone is mounted in a steel channel that forms a support the entire length of the stone, and it is held in place by a gib and hollow setscrew. The abrasive stones used have been especially developed for honing purposes, and are said to remove metal at a rapid rate without loading, and to hone and polish the surface in the same operation. No liquids nor honing compounds are necessary.



AMMCO CENTRIMATIC CYLINDER HONE

The self-adjusting and self-centering features of the tool arise from the fact that the wings are attached by links to a pair of disks. The action is co-ordinated so that all the stones are held at the same distance from the center. The hone requires no adjusting nor setting; the operator needs only to watch the diameter of the bore. At the right side of the illustration herewith the tool is shown expanded in the top and contracted in the bottom view. The range is from 2½ to 4 in. diameter.

A set of extension blocks is provided for use with cylinders of from 4 to 5 in. in diameter. No adjustment is necessary in connection with the use of the blocks other than the mounting of the blocks and hones, as shown at the bottom.

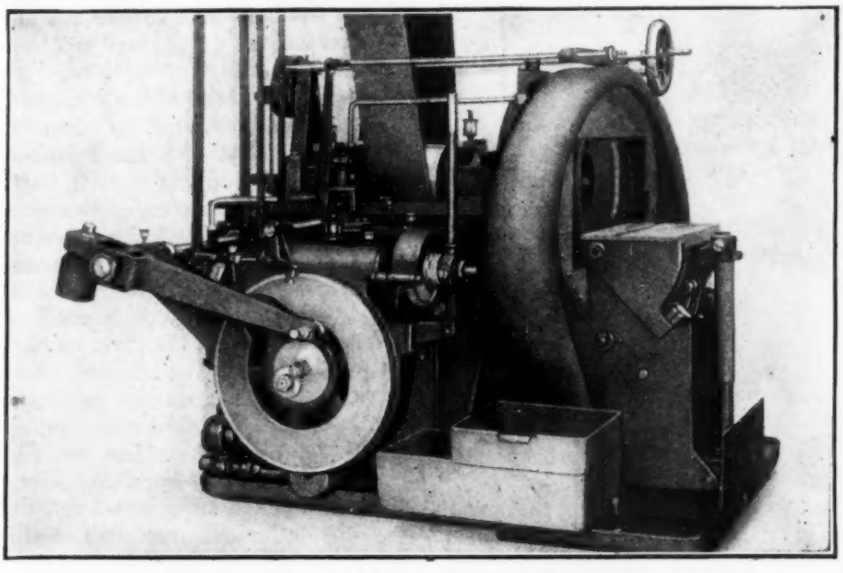
The tool can be operated by a drilling machine, honing machine or portable drill. The best results are obtained when a speed of from 800 r.p.m. to 1,100 r.p.m. is maintained.

Osterholm Automatic Surface Grinding Machine

The Osterholm automatic surface grinding machine described on page 242, Vol. 55 of the *American Machinist* has been improved in many details and is now being manufactured by Williams, White & Co., Moline, Ill. This machine is adapted for production work on automotive and tractor parts, sections and ledger plates of harvesters, electrical parts, pulleys, poppet valves and parts of similiar nature.

Both the bed and trunnion are of cast iron, the latter supporting the work table and oscillating on two bearings in the base. The wheel housing, in which is mounted the spindle carrying a 20-in. abrasive wheel, moves back and forward on guides on top of the base. A cam, mounted on the side of the machine and driven by a separate belt from the lineshaft by means of a combination of change gears, controls the position of the 12½x24 in. work table, and determines the velocity and amount of travel of the wheel housing toward the work.

By shifting the arrangement of these change gears, which are located at the left-hand side of the machine, the cycle of the machine is altered, the oscillations of the work table in front of the wheel being fixed and bearing a definite relation to the revolutions of the wheel. The pump is driven by a separate belt; it circulates water through the wheel spindle and whenever necessary through the holding fixture, so that during the grinding operation the work is flooded with water. Slush pans are provided to insure an ample supply of clean water.



OSTERHOLM AUTOMATIC SURFACE GRINDING MACHINE

The entire machine is supplied with positive oiling devices. Lubrication is obtained by means of large oil reservoirs, cast as a part of the wheel housing, that provide an ample supply of oil for the spindle bearings. These bearings, as well as all other moving parts, are all protected from the destructive action of the grit and water incident to grinding. Curtains are also provided for each setup that practically seal the machine, so that no water is thrown out.

The operation of the machine is as follows: With the work mounted on a suitable fixture, the machine is started by pushing the control handle which, by shifting the auxiliary belt, starts the mechanism controlling the oscillation of the trunnion and work table and the revolution of the feed cam. During the first few degrees of the cam's revolution the cam follower makes an abrupt fall. In this motion the work table is raised into the operating position, where it remains for the balance of the cycle.

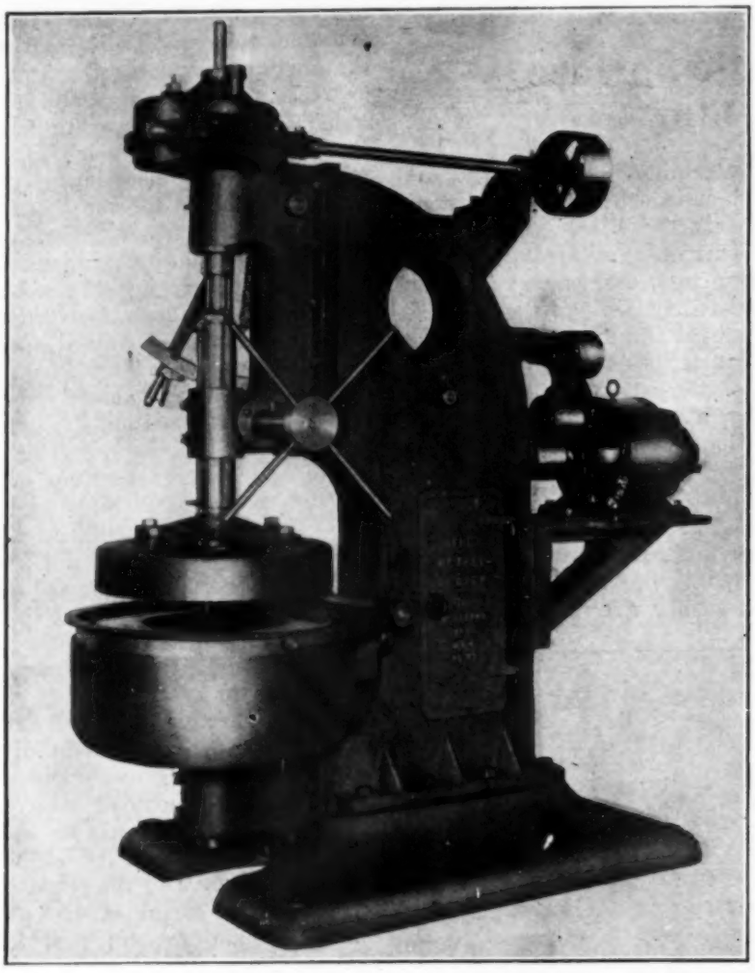
As the cam continues its rotation, the housing carrying the abrasive wheel is moved slowly forward until it reaches a pre-determined advance position. At this point the cam flattens and causes the wheel to remain in its advance position for several oscillations of the work table, thus causing any uneven portions on the surface of the piece to be ground. The cam then abruptly raises the follower, and causes the work table to drop to its original or unloading position. This last motion of the follower automatically shifts the auxiliary belt and brings the cam and work table to rest.

Wear of the abrasive wheel is compensated for by adjustment of the handwheel above the work table. The wheel itself is mounted in a steel draw-in chuck, which has an adjustable plate that makes it possible to advance the wheel in the chuck as it wears. A coil spring at the base of the cam follower arm provides a cushion to prevent injury to the machine or wheel in case the work should become jammed on the closing of the work table. The machine is further protected by an emergency stop lever within easy reach of the operator. A thrust on this lever will stop the machine at any point.

The machine occupies a floor space of 72x84 in., is 60 in. high and weighs 7,000 lb. Its capacity is for pieces up to 10x40 in., and from 20 to 30 hp. is required when operating at its maximum. The countershaft has a speed of 330 r.p.m. and produces a spindle speed of from 900 to 1,000 r.p.m. The stroke length can be varied from 2 to 24 in., while the time of the operating cycle varies from 10 sec. to 2 minutes.

Bethel-Player Lapping Machine

The Bethel-Player Co., Westboro, Mass., has recently brought out a vertical lapping machine of large size for the purpose of lapping round work, either parallel sided or tapered, up to 3 in. in diameter by 8 in. long. The machine is similar in principle to the Fraser lapping machine, also a Bethel-Player product, and described on page 888 of the *American Machinist*; but it is of larger capacity and has the working parts inverted.



BETHEL-PLAYER LAPPING MACHINE

In this machine the stationary lap is at the bottom, as can be seen in the accompanying illustration, while the upper lap is revolved by a spindle similar to that of a drilling machine. The upper lap is attached to the spindle by a floating connection that allows it to adjust itself to any slight deviation from parallelism with the lower lap that may be caused by irregularities in the work before the lapping operation commences.

The bronze wormwheel and hardened steel worm through which the spindle is driven are in the case at the top of the bracket. In this case, also, is the differential gearing by means of which the central or "break" shaft is caused to revolve at a slower rate of speed than the lap. Radially adjustable pins in the lower end of the central shaft engage with suitable holes in the work carrier, and cause the latter to take up a gyratory motion relative to the laps that sweeps the work over all parts of the lapping surfaces and thus distributes the wear.

A fixed basin surrounds the lower lap for the purpose of catching all excess lapping compound that may be thrown off by the lap or work. An upward extension of this basin is provided by a movable ring, or splash guard, that is so interconnected by levers with the vertical movement of the lapping spindle that when the lap is lowered into contact with the work the splash guard is automatically raised to enclose completely the revolving parts.

The machine is designed to be driven by belt directly from the line-shaft, or from an independent driving motor mounted upon a bracket at the rear. Spring suspended idlers serve to relieve the shock of quick starting and to maintain a uniform tension upon the driving belt.

The principle of the lapping involves a combined rolling and sliding motion of the work over the surfaces of the laps, the amplitude of which motion is variable in accordance with the size and nature of the work, by adjusting the amount of eccentricity of the pin in the lower end of the central shaft. Suitable work carriers are provided for the various classes of work to which the machine is adapted.

The floor space occupied by the machine is 5 x 8 ft.; the height 7 ft. and the weight 6,800 pounds.

"American Beauty" Electric Soldering Iron

The American Electric Heater Co., Detroit, Mich., has recently placed on the market the electric soldering iron shown in the accompanying illustration. This iron is suitable for light, medium and heavy soldering operations where electric energy is available.

The core of the heating element and the shank of the copper tip are heat treated, so that they will not readily corrode or oxidize. By means of a non-conducting compression winding, the heating element, which is of nickel-chromium ribbon insulated with mica, is kept in intimate contact with the core, thus preventing overheating of the element. The copper tip is of straight rod construction without an enlarged head. As the tip wears away, it is possible to withdraw it from the core, so that most of the tip may be utilized. The exterior of the iron is perfectly smooth, with a polished nickel finish on all metal parts and an ebonoid finish on the wooden handle.

A 6-ft. cord and lamp socket attachment is supplied. Three sizes of the iron are available with soldering tips

"AMERICAN BEAUTY" ELECTRIC SOLDERING IRON

$\frac{3}{4}$, $\frac{7}{8}$ and 1 in. in diameter. These irons require 100, 200 and 300 watts, have an overall length of 12¼, 13 and 13¾ in., have an outside overall diameter of $\frac{1}{2}$, 1¼, and 1⅞ in. and weigh 18, 26 and 42 oz., respectively.

Fraser Nos. 132-A and 142 Automatic Grinding Machines

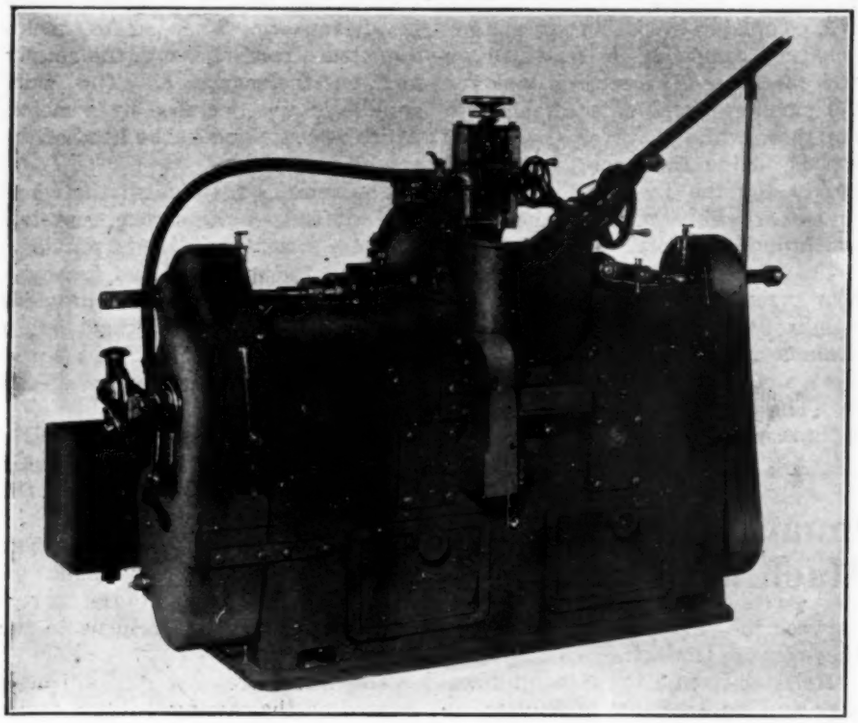


FIG. 1—FRASER AUTOMATIC GRINDING MACHINE NO. 132-A

The Warren F. Fraser Co., Westboro, Mass., has recently brought out two automatic grinding machines similar to the machine described on page 491, Vol. 56, of the *American Machinist*, for grinding round work upon centers. The work is fed to the grinding wheel from a stack, or chute, into which the pieces to be ground are placed by the operator. The operation is thenceforward fully automatic, a work piece being taken from the bottom of the stack by the work carrier, placed between centers, ground to diameter and passed to the delivery chute at each cycle of the machine. While designed primarily for the automotive field, as in grinding piston pins and pistons, the machine will handle readily any cylindrical work that falls within its range, provided that the work pieces may be centered.

Each machine has two work spindles, independently driven by silent chains, both turning in the same direction and at the same speed. Both centers are, therefore, live centers and the work is held by and driven from both ends. The spindles have a slight periodic movement endwise, operated by cams, so that a finished piece of work is deposited in the delivery chute and an unground piece picked up from the work carrier at each cycle of the machine.

The wheel-head of the smaller or No. 132-A machine is mounted upon a gibbed slide that is given an intermittent forward and back movement by means of a cam. The wheel spindle is caused to traverse endwise for a very short distance only, and for the purpose of forestalling a tendency to grind rings in the work. Except for this slight movement the grinding is done by what may be called a "set" wheel, moved to and from the work by the cam as required.

Besides the cam movement, the wheel slide may be moved forward or backward at any time independently of the cam by means of a screw and handwheel. This movement is of importance in setting up and in compensating for wear of the wheel caused by continued use and redressing.

The larger, or No. 142, machine, while essentially the same in principle as the smaller one, is of greater capacity and differs somewhat in detail. In this machine, shown in Fig. 2, the wheel, though still mounted upon a slide for the purpose of inde-

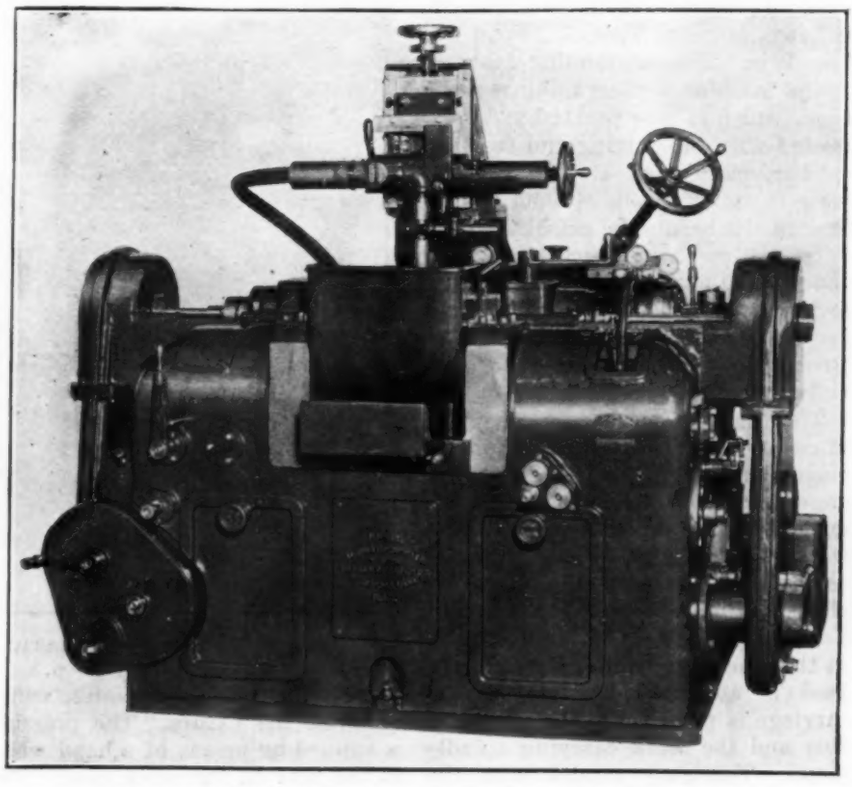


FIG. 2—FRASER AUTOMATIC GRINDING MACHINE NO. 142

pendent adjustment, runs in eccentric bearings that are susceptible to a rocking motion which carries the wheel to and from the work. This spindle, also, is given a vibrating endwise movement to avoid grinding rings in the work.

Each wheel-head is provided with a reservoir for oil and forced lubrication is supplied therefrom to the bearings by means of a pump. The work-heads are enclosed and the parts run in an oil bath. All chains, cams, and other moving parts are suitably guarded.

A truing device, which is essentially a slide-rest for carrying a diamond tool, is permanently mounted upon the hood of the grinding wheel, so that redressing the latter when necessary is quickly and easily accomplished.

The smaller machine carries a wheel that is 4 in. wide, representing the maximum length of work that can be ground, and will handle pieces up to 3 in. in diameter. The larger machine may have a wheel 6 in. wide, or two or more narrower wheels, mounted upon its spindle and dressed to different diameters for the purpose of form grinding shouldered work. This machine handles work larger than 3 in. in diameter, and is suitable for grinding the pistons of automotive engines.

A complete circulation system for grinding compound is provided on each machine. The settling tank for the smaller machine is attached to the rear, while that for the larger one is inside the base; which accounts for the fact that both machines are of practically the same width upon the floor.

The No. 132-A machine occupies a floor space of 6 ft. by 5 ft. 4 in., and weighs 5,000 lb. The No. 142 machine covers 7 ft. by 5 ft. 2 in., and has a weight of approximately 8,000 lb. The heights are 5 ft. 4 in. and 6 ft., respectively.

"Teromatic" Automatic Internal Grinding Machine

The "Teromatic" automatic internal grinding machine, which is a further development of the No. 12 automatic internal grinding machine described on page 662 of the *American Machinist*, has recently been placed on the market by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The outstanding feature of the machine is the gaging mechanism, which is incorporated and correlated with the driving and feeding mechanism in such a way that the piece is automatically ground to the desired size before the machine stops. After the operator chucks the piece and starts the machine, the carriage oscillates automatically, the wheel feeding against the work at each stroke until the hole is of the required size.

The gaging mechanism is contained in the head, and as the carriage travels along the machine, the gage travels in the same direction until it comes in contact with the work. As long as the hole is too small for the gage to enter, the carriage continues its reciprocating motion; when the hole is large enough so that the gage enters, the carriage feed is automatically tripped, the carriage is returned to the rest position and the work carrying spindle stops. The gage rotates with the work, so that there is no friction between the gage and the work when they come in contact.

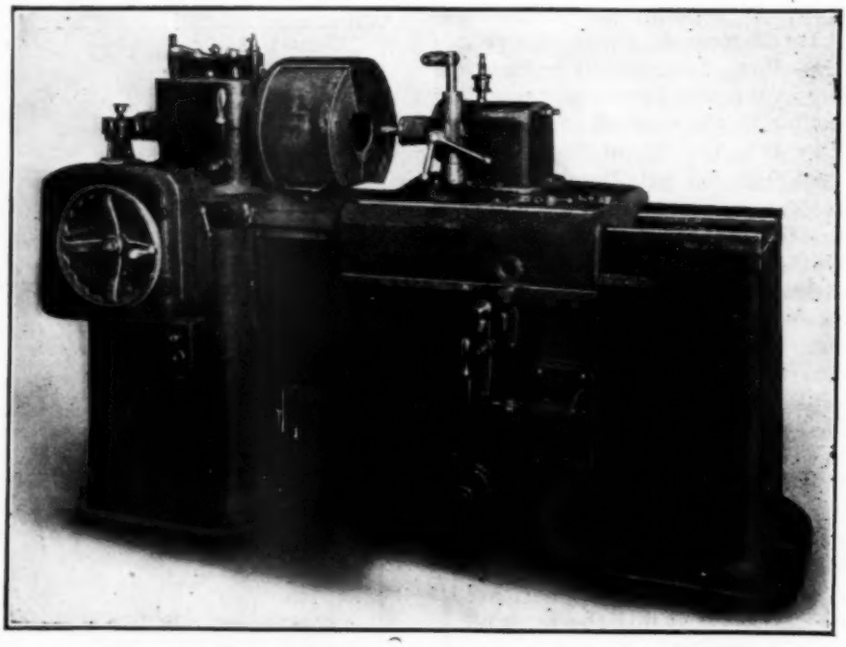
Holes of from ¾ to 10 in. in diameter and up to 9 in. in length can be ground, the work being held by pressure between two plates, which comprise the fixture. The pressure is applied by means of a hand wheel at the rear of the work head. The swing is 15½ in. over the carriage and 14½ in. inside the water guard. The center of the spindle is 44 in. above the floor.

The machine is motor-driven and entirely self-contained, being equipped with push-button control. The carriage is reciprocated hydraulically, the pump being operated by a motor which is mounted on the back of the bed. The wheel spindle is driven by a separate motor mounted directly beneath the spindle and on the carriage. The work spindle is also operated by a motor, which is contained in the head of the machine.

The work is fed against the wheel at each end of the stroke, and two separate series of feeds are provided, ten each for roughing and finishing. Six speeds of rotation are provided for the work. The carriage has a maximum travel of 20 in., and is provided with six traversing speeds from 7 to 45 ft. per minute.

Coolant is handled by a directly driven centrifugal pump mounted within the machine, so as to force the lubricant through the center of the work spindle and on the work. The coolant is automatically shut off when the hole is ground to the correct size and the carriage returns to the rest position.

The wheel dressing mechanism is located on the carriage; it can easily be adjusted for operation and readily swung out of the way. Tapers can be ground to an included angle of 30 deg. The floor space required is 86x54 in., and the net weight of the machine 3,900 pounds.



"TEROMATIC" AUTOMATIC INTERNAL GRINDING MACHINE

News Section

Discuss the Problems of Steel Treating

That the spirit of co-operation that has been developed among the metallurgists of the country is responsible for developments in the art of working metals which will revolutionize the steel industry, is the impression gathered at the Eastern sectional meeting of the American Society for Steel Treating which was held at the Hotel Bethlehem, Bethlehem, Pa., June 14 and 15. Twelve of the 28 chapters of the society were represented, namely, Lehigh Valley, under whose auspices the sectional meeting was held, Philadelphia, New York City, Syracuse, Buffalo, Pittsburgh, Boston, Worcester and Springfield, Mass., Hartford and New Haven, Conn., and Schenectady.

Registration showed the attendance to be 175, which included a number of engineers, metallurgists and manufacturers who are not identified with the society, but who wished to obtain the benefit of the valuable matter that was placed before the society by the various speakers. The members and visitors were welcomed by Chairman A. P. Spooner of the Lehigh Valley chapter and the response was made by T. D. Lynch of Pittsburgh, president of the National Society. An address of welcome was also made by Archibald Johnson, vice-president of the Bethlehem Steel Co. The following papers were presented: "Behaviour of Metals under Normal and Sub-Normal Temperatures," Dr. F. C. Langerberg, Watertown Arsenal, Watertown, Mass.; "Equalization of Internal and External Strains in Tool-Steel," F. R. Palmer, Carpenter Steel Co., Reading, Pa.; "Case-Hardening," B. F. Shepherd, Ingersoll-Rand Co., Phillipsburg, N. J.; "Practical Metallography," R. H. Christ, Bethlehem Steel Co., Bethlehem, Pa.; and "The Developments of Heat Resisting Metals," V. Hybonette, British-American Nickel Co., Wilmington, Del.

Banquet Speakers

Monday evening a dinner was given in the ball-room of the Hotel Bethlehem, at which the national president presided. The speaker of the evening was Dr. E. J. Cattell, Philadelphia, Pa., and his remarks emphasized the value and importance of the work that is being done by the Society for Steel Treating. Music was also provided by the Lehigh Valley chapter.

Friday morning was spent in a trip of inspection through the plant of the Bethlehem Steel Co. and at noon a lunch was served in the company's dining room. The Friday afternoon meeting was held at Lehigh University, and was presided over by Sam Tour, of the Doehler Die Casting Co., chairman of the New York chapter. An address was made by President Richards of Lehigh University, in which he outlined certain future developments at the university and their relation to the future of the steel industry.

A number of ladies were also present. While the members were attending the Thursday afternoon meeting, the ladies were entertained with an automobile trip to the Delaware Water Gap. Friday morning the ladies were taken on a sight-seeing tour of the historical points of the city, and Friday afternoon they were entertained at a card party at the university.

Hoover Predicts Loss in Dry Ship Ruling

Loss to American shipyards of some repair work on foreign vessels, and loss of some bunker coal business and ship's stores sales may be expected as a result of the ruling against admission to American waters of any vessel carrying intoxicating liquor, in the opinion of Secretary of Commerce Hoover.

Secretary Hoover, in commenting upon the ship's liquor regulations, pointed out that probably port-of-call and transshipment business which is a minor part of the business of some vessels will be dropped by them rather than conform to the prohibition rulings. Vessels bound from Europe to South America, for instance, which ordinarily might touch at a United States port for coal and supplies, and necessary minor repairs, probably will make it convenient instead to go to the West Indies for such purposes, it was pointed out. This business loss, if the event supports this opinion, will be a necessary part of the price the United States must pay for prohibition, the Secretary said.

John Hayford Resigns from Aeronautic Board

Because he felt that Dr. S. W. Stratton, formerly director of the bureau of standards at Washington, D. C., will be in a position to render more effective service as a member of the National Advisory Committee for Aeronautics, Director John F. Hayford, for eight years a member of that body, has tendered his resignation. Director Hayford, who is head of Northwestern University School of Engineering, was appointed to the aeronautics board in April, 1915, by President Woodrow Wilson and had served ever since without compensation.

Dispute Board Proves Valuable Adjunct

The Bethlehem plan of employee representation, under which all disputes arising between the workers and the management of the Bethlehem Steel Co. are settled, recently completed its fifth year of operation. During the period a total of 2,365 cases, covering virtually every possible complaint that could be broached by the employees, was brought to the attention of the management, and all except forty-nine have been settled. Decisions in the forty-nine cases are expected soon.

Dr. Stratton Installed as M. I. T. Head

On June 11 the attention of the academic world was focussed on M.I.T. Dr. Stratton, former head of the Bureau of Standards, officially took the president's chair of the Massachusetts Institute of Technology at that time. Speakers of note were present to address the large body of faculty, students and alumni gathered at Horticultural Hall, where the ceremonies took place.

Frederick P. Fish acted as master of ceremonies at the inauguration. Major-General George O. Squier spoke with feeling of his 15 years' close association with Dr. Stratton in connection with army problems. For the factulty, Prof. Edward P. Miller greeted the new president, pledging co-operation and firm loyalty. Governor Channing Cox glorified the commonwealth of Massachusetts in having such an institution, with such a faculty, within its bounds. The founders of Technology, Mr. and Mrs. William Barton Rogers, received a tribute from President Emeritus Charles W. Eliot of Harvard. Professor C. E. A. Winslow of Yale represented the alumni at the ceremonies.

In the evening the new president acted as toastmaster at a banquet at the Algonquin Club. Dr. A. Lawrence Lowell, president of Harvard, Prof. Edgar Odell Lovett and Prof. Theodore W. Richards were among the speakers at this gathering. Professor Lovett, of the Rice Institute in Texas, spoke of education in that state. Professor Richards presented greetings from the Royal Society, the Royal Institution and the Chemical Society of London. President Ira Nelson Hollis of Worcester Polytechnic Institute, an old friend of Dr. Stratton, spoke in praise of the man "who, if he can persuade Congress to support the Bureau of Standards, is well equipped to meet Tech's problems."

Professor Allard of the Ecole Normale Supérieure of Paris, Dean Kimball of Cornell, Dr. Zook of the U. S. Bureau of Education and Dean Clark of the University of Illinois also spoke.

Freight Car Mileage is Increased

Freight car performance statistics just compiled for April by the Bureau of Railway Economics show that the average daily movement per freight car during that month was the greatest for any month since the fall of 1920 when freight traffic was especially heavy.

The daily average for the month was 28 miles which also was higher than the average for any April since tabulations of these statistics began in 1917. The average for April was an increase of one mile over that for March. It also was an increase of $6\frac{7}{10}$ miles over the average for April last year and $7\frac{1}{10}$ miles over the average for the same month two years ago.

Steady Business Marks Buffalo Trade

Manufacturers in the Buffalo district report that sales of forges, drilling machines, punches and shears and like equipment, both large and small, are holding up remarkably well for this time of the year. The market is lively and there are a great number of inquiries for future business.

Large and small fans for industrial use are in good demand and the Buffalo Forge Co. reports that its fan business at this time is running from 25 to 30 per cent ahead of the same period last year.

Machine tool dealers of Buffalo are optimistic over the prospects for future business, although some of them admit that their sales for the first half of June have not been exactly what they had hoped. In general, the slight slump that was evident the first half of May was overcome by the last of the month and many of the dealers had a bigger month than a year ago in May, with business falling off a trifle after the first of this month. This seems to be a period of rapid fluctuations in sales and the dealers therefore are predicting that the rest of June will be good enough to bring this month well ahead of June, 1922 in sales volume and are basing this assumption on the large number of small orders which they are working on.

Most of the machine tool business at present consists of small individual orders and, so far as can be determined, there is not a single large list out in the Buffalo territory.

The demand for drilling machines of the upright type is strong and this seems to be the outstanding feature of the market.

Lathe business is fairly steady and shapers are fair. Some specials, especially grinding machines, are being figured on.

The market for second-hand tools continues rather strong and somewhat better than that for new machines.

Alabama Pig Iron Output Reaches Peak

According to present indications the peak of production has now been reached in the Alabama iron and steel district, and the pig iron melt is expected to remain comparatively stable now for the next few months. Substantially this same condition prevails in the metal trades industry over the entire southeastern territory.

Keen Rivalry in Mining Says Merritt

In a statement to the United States Coal Commission, Walter Gordon Merritt, counsel for the anthracite operators, called attention to the highly competitive condition in the anthracite industry and the lack of any dominating influence on the part of any one company or group.

"The popular impression to the contrary," the statement said, "grows out of passed litigation, forcing a separation of railroad and mining operation and dissolving the intercorporate relations which were held by the courts to be in restraint of trade.

"That impression, based on happenings in the past, has outlived the condition to which it owes its origin, that the public is reluctant to surrender it."

The statement shows that while eight companies in active competition with each other produce about 74 per cent of the total output of anthracite, the largest of these produces only about 15 per cent of the total and that more than one hundred so-called individual operators produce about 26 per cent.

"The balance of power," the statement continued, "is so distributed that there can be no domination by any one concern or organization. The percentage of the total output market by individual operators has increased since 1902, thereby showing that their growth is not being prevented and that centralization is not progressing.

"There is no apportionment of territory. A notable number of operators sell to the same communities and dealers—a condition so much a part of competitive waste as not to be consistent with the purchases and existence of monopolistic control."

Fewer Men Unemployed During May

Fewer men were unemployed during May than at any previous time during the preceding twelve months, the United States Employment Service, of which Francis I. Jones is Director, announced recently. Reports from all sections of the country indicated that practically everybody who wanted a job could find one and that in many of the trades and industries, as well as in the agricultural districts, there was an actual shortage.

As to the situation in sixty-five industrial centers, where the service bases its findings on reports from 1,428 firms, the report showed that employment gained in the industries and cities by 0.39 per cent. over April, and that in many of the major industries "there is a demand for common and skilled labor which is far greater than the available supply."

Employment in the steel industry is described as "exceedingly bright," with a "tremendous demand."

Bookings of Steel Castings Show Decline

The Department of Commerce announces that May bookings of steel castings made a slight decline from April, based on reports received by the Bureau of the Census in co-operation with the Steel Founders' Society.

The bookings in May by companies representing over two-thirds of the commercial castings capacity of the United States amounted to 89,463 tons, as against 90,968 tons in April. Bookings for both railway specialties and miscellaneous castings declined.

Starrett Prize Winners Are Announced

The L. S. Starrett Co., makers of precision tools and hacksaws, has recently announced the winners of the recent prize contest on "How Starrett Tools have helped me most in my work."

Toolmakers and machinists won a majority of the prizes carrying off 377 of the total 474 which were awarded.

The four main prizes were won by the following: Robert N. Walters, Racine, Wis., Harry Gibler, De Beque, Colo., Leon H. Rice, Manchester, N. H., and Wm. S. Clark, Chicago.

New York Markets are Fairly Active

Dealers in machine tools and machinery in the New York district report this week that business is as good as can be expected for this time of the year and that, while the volume is not up to the first few months of the year, sales are keeping up remarkably well. There is every reason to believe that June business will be far ahead of that for the same month last year and a close runner-up for May and April of this year.

The railroads are still buying in fairly good quantities and the inquiries are steadily arriving at the various offices in the district. The Central Railroad of New Jersey was in the market last week as well as the Lehigh Valley. The Pennsylvania R.R. is about ready to purchase equipment according to prediction and machine tool dealers are anxiously awaiting the actual orders from this road.

Textile machinery is not selling as briskly as it was, but still it is moving fairly well for this time of the year. Automobile manufacturers are purchasing moderately which is unusual for June.

In the used tool market things are rather quiet with efforts being made to speed up business along special lines and in the unusual markets. In every quarter the predictions are for exceptional business in the Fall and a Summer that will be busier than usual.

Finances with users of machine tools are better than usual at this time of the year, according to reports from dealers. Collections are proving good and obligations are met promptly by most of the manufacturers throughout the country, despite summer seasonal quietudes.

Completing Work on the Pitcairn Yards

With a view toward completing the first of many proposed changes in the repairing of freight cars in the Pittsburgh district, work is being rushed on four new shop buildings in the Pitcairn, Pa., yards of the Pennsylvania R.R. The new structures will probably be ready to take care of the repairing of the new heavy steel coal and ore cars about Oct. 1, and hundreds of additional men will be needed. The shops will become the finest on the Pennsylvania system, as after these improvements, costing $1,000,000, are finished, the shop will handle all repairs between Altoona, Pa. and Columbus, Ohio.

More Freight Cars in Need of Repair

An increase of 1,523 freight cars in need of repair on June 1 over those of May 15 is shown by the report of the American Railway Association. Total freight cars throughout the United States in need of repair on the first of this month were 211,766, or 9.4 per cent of the cars on the line, the report says.

Of this number 155,564, or 6.9 per cent of the cars on the line, were in need of heavy repairs, an increase of 303 over the number in need of such repair on May 15. Freight cars in need of light repair totaled 56,202, or 2½ per cent of the cars on line, an increase of 1,220 cars during the semi-monthly period.

Busy Summer Expected in Philadelphia

Indications of continued business activity throughout the Summer and early Fall are apparent among manufacturers and jobbers in the Philadelphia district. A few industries show a falling off in volume due mostly to seasonal conditions, it is reported.

A recent inquiry developed that eight of the largest industries in Philadelphia have orders on hand to keep most of them going until the end of the year, and all will be active throughout the Summer. These plants include the Electric Storage Battery Co., the Tioga Steel & Iron Co., J. G. Brill & Co., the Baldwin Locomotive Works, the Southwark Foundry & Machine Co., the Tacony Forge Co., the William Cramp & Sons Ship & Engine Building Co., and Henry Disston & Sons, Inc.

New orders in all the lines produced by the above named concerns have been coming in, although not in as great volume as was the case during the first four months of this year.

Philadelphia sales offices of midwestern steam shovel manufacturers report business for this period of 1923 has increased about $100,000 above the corresponding period of 1922. There is a demand from anthracite mines, stone quarries, cement manufacturers, and excavators for large building operations.

The New York Shipbuilding Corp., with yards at Camden, N. J., has received a $700,000 order for ten new car floats for the Pennsylvania R.R. It is one of the largest orders for this equipment placed in this district in some years. Delivery is to start Oct. 15 and completed by Jan. 1. The floats will be used in the New York-Jersey City service.

Manufacturers of electric signs report a good demand, and a similar condition exists among the producers of automatic heat regulators. Several of the large building operators are installing this equipment. Gas range production in this district also is reported good.

The scarcity of labor is being manifest in many industrial establishments. According to the state labor bureau the good workers have been grabbed up, leaving the poorer quality in both common and skilled work to fill in where there is an excess. During the early part of the Spring and Summer many Scotch and English mechanics sought employment here in shipyards and in other industrial plants, but the restrictive immigration laws have stopped the inflow for the present.

Railroads Place Orders in Chicago

There is very little activity as regards purchase of machine tools by industrial concerns, but the railroads continue to save the situation by being rather active buyers. The Santa Fe R.R. has purchased machinery for which inquiries were made recently, except a few machines; the Chicago & Northwestern has made some additional purchases and the Denver & Rio Grande is active. The Chicago, Burlington & Quincy has not yet started to make purchases on the list that is pending. The Yellow Coach Manufacturing Co. purchased a couple of machine tools, a lathe and a drilling machine, this week.

The general tendency in the iron and steel trade is firm, but concessions have been granted in some instances, but not by the leading interest. The lower prices are accepted in a few instances by small producers who are able to book business for fairly prompt delivery.

Milwaukee Busy Filling Old Orders

Although the Milwaukee machinery market in general is less brisk than for the past four to six months, it is far from being quiet. Sales continue to hover near the peak point, while there has been no letdown in production save that which might be compelled by the shortage of skilled labor and partial and temporary depletion of working forces by the vacation season. It is true, however, that most plants are decreasing unfilled orders, and advance bookings are not so heavy as before, while output is kept on a fairly even level.

Manufacturers of milling machines, one of the principal divisions of the machine tool building industry in Milwaukee, are receiving new orders which with unfilled requirements, will insure continuous operation without letdown until early fall. This division at no time reached maximum capacity, but is finding demand as active now as it has been at any time since the passing of the post-war depression. No round lots have been booked in the past sixty days, but orders for one or a few machines form a moderate aggregate. Automobile factories and shops manufacturing engines and other parts are steady buyers, although needs appear to be confined to replacement of obsolete, wornout or inefficient types with the latest developed designs having greater production possibilities as well as wider range of usefulness and at the same time make possible a material saving of labor.

Lesser activity is expected to come with the passing of June, which will be a seasonal development and is not considered a reflection of shrinkage in the general business volume of the iron, steel and machinery trades.

The advancing movement of machine tool and machinery prices has not yet spent its force, but it has become noticeable that many users display an indifferent attitude unless their needs are such that they are compelled to place orders. Inquiry is generally heavy, but when analyzed it is found that a dozen sellers receive inquiries from the same source to test out prices as well as ability to make deliveries.

Railroad lists command probably the most attention at present, yet disappointment is expressed that purchases against these lists are being made in very small quantities.

While purchases of cranes in the aggregate show a falling off, unfilled orders and current bookings remain sufficient to keep shops booked well forward.

Inquiry for structural steel has declined, probably because major construction operations for this year have been covered. Few new sizable undertakings are being projected. At the same time, local fabricators have their hands full and some are not interested in new inquiries excepting when these relate to delivery expectancy after three months. General satisfaction is expressed by Milwaukee manufacturers.

The South in Excellent Condition

Industrially and financially the Southeast is in the best condition it has been in for several years, with every indication that 1923 will prove one of the best industrial years in the history of the district, according to a report of the Federal Reserve Bank of Atlanta, Georgia.

This report is further borne out by the fact that since the first of the year there have been more new industrial and manufacturing companies organized in the district than ever before over a similar period, and that existing companies are carrying out more construction of additional units than ever before.

Since the first of the year to the end of May there were 146 announcements of new foundry and machine companies or new construction by existing companies. There were 23 such announcements in May. There were three new iron and steel companies formed in May, bringing the total for the first five months to eleven. Of metal working plants, not included above, there were 24 such announcements in May, making 129 the year's total.

In the Alabama district there has been a steady increase in iron production since the first of the year, according to the Southern Metal Trades Association of Atlanta, and there is every promise that 1923 will prove one of the largest years in history. The association also advises that there has been a steady increase among all of its member plants throughout the South.

Pig iron production in Alabama is now running at about 3,000,000 tons per annum on the average, about 75 per cent larger than at this time last year.

A steady increase in the export volume out of Southeastern ports is also reported by the Southern Metal Trades Association, with a promise that export trade will continue on the same active basis throughout the year.

St. Louis Factories Are Well Employed

There has been very little change in the condition of the machine tool market in St. Louis, Mo., within the past two weeks. Future orders are keeping most of the shops going on full time schedule, but there have been few new orders taken. Railroads are not buying to any extent and, while they speak of building new shops and making other necessary improvements and repairs, they are holding back because of the uncertainty as to the future.

Some men in the machine tool trade look for this condition to obtain throughout the Summer and even anticipate an aggravation of the decline, but expect a betterment toward the Winter. On the other hand there are those who do not agree with this somewhat pessimistic view and maintain that the present slump will be very short lived.

Reports of the members of the St. Louis Branch of the National Metal Trades Association show an encouraging increase in business and practically all concerns affiliated with the association are working full time and the prospects for the immediate future are good. Orders which are keeping these plants so well supplied with work were taken some time ago.

News of Washington Activities

BY PAUL WOOTON

While members of the President's Coal Commission are being particularly careful not to anticipate any of the conclusions which may be reached in the anthracite report, it is hard to see how they can avoid passing on two great industrial problems, *i.e.*, competition versus centralization, and what procedure is to be followed when labor and capital fail to reach an agreement whereby the public might be made to suffer.

In all industry there is no better illustration of highly concentrated corporate ownership and of run-away competition than is afforded by the anthracite and bituminous mining operations in the United States.

The Commission's study has brought out clearly the stabilizing effect of this concentrated ownership on supply and price. The members of the Commission, it is known, have been impressed with the success of the anthracite producers in preventing a run-away market during the past winter, through their control over the bulk of the tonnage. Such flurry as there was can be blamed on the competition that does exist many believe. There are some who believe a majority of the Commission would oppose any effort to break up the closely knit business organizations which produces most of the anthracite. They may have some suggestion in their report as to the means which can be employed to prevent possible abuse of this control. It is hard to imagine how the Commission can make a report on anthracite coal without passing on the merits of that type of control. In the bituminous industry many things can be done which would improve the situation, but in anthracite the outstanding questions are two—centralization and labor relations.

The situation in the anthracite field is such that it seems highly probable that the report will have some suggestion as to what additional machinery is to be set up for use when the operators and mine-workers cannot reach an agreement. In anthracite each side is 100 per cent organized. The employees present a homogeneous front and the operators are always in step. For nearly twenty years their differences have been handled in a fairly satisfactory manner through the existing machinery, but it is recognized that it is not adequate when a major difference occurs.

The Public Suffers

When a deadlock occurs under present conditions, the two parties to the controversy either fight it out or voluntarily agree to some form of arbitration. In the former case, the public frequently is denied adequate fuel supply while the contestants engage in the fighting out. Arbitrators in the past usually have been undertaken after great losses have been suffered and after coal production has been long reduced. None will be surprised if the Coal Commission were to prescribe the exact form arbitration would take. It may not go so far as to make arbitration compulsory, but it may have some plan whereby the arbitrational machinery is expected to begin to function immediately that a deadlock is reached, with reliance placed on the force of public opinion to bring about its use.

Chairman Hammond stated that the Commission is wrestling with the valuation problem. The situation with regard to valuations is affected importantly by recent decisions of the Supreme Court of the United States. He admitted that the public will be very critical of the valuations used in the computing of profits in the anthracite industry. The report of the special advisory committee on valuations had not been received on that date, however. Mr. Hammond brought out that it is unfortunate that the law prescribes an exact date for the issuance of the anthracite report. If the Commission had three weeks more time a more complete report could be made, he stated. He admitted, however, that the Commission has had before it for some time a large enough proportion of the returns from the industry to enable members to form conclusions contingent on corroboration by the remaining returns covering the full tonnage. The report made by Senator Pepper on the legal aspect of royalty regulation has been received.

The Commission is going minutely and carefully into the whole question of the check-off, Mr. Hammond revealed.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.034	$0.034	$0.0252
Cold finished shafting	per lb.	0.042	0.042	0.0328
Brass rods	per lb.	0.1850	0.1913	0.1533
Solder (½ and ½)	per lb.	0.2862	0.2812	0.22
Cotton waste	per lb.	0.1231	0.1231	0.104
Washers, cast iron (½ in.)	per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.08	2.96	3.11
Lard cutting oil	per gal.	0 608	0.592	0.575
Machine oil	per gal.	0.349	0.349	0.383
Belting, leather, medium	off list	42½%	42½%	46½%
Machine bolts up to 1 x 30 in.	off list	44¼%	44¼%	62½%

Two Important Plants Are Visited

The Industrial Relations Association of western Massachusetts at its June meeting met at the plant of the American Bosch Magneto Corp. in Springfield, Mass., and motored to Greenfield, where the members were entertained by the Greenfield Tap & Die Corp. After the plant was inspected the party enjoyed a trip over the Mohawk Trail, returning for the dinner and business meeting, at the Weldon Hotel in Greenfield. The association is making visits to important manufacturing plants in New England each month.

Pittsburgh Confident of Improved Conditions

A slight restriction has been felt in the machine tool buying in Pittsburgh in the past two weeks, as well as a falling off in machine orders generally. Sellers of new equipment are not pessimistic over the situation as they feel that the business is here and must be placed sooner or later, when the labor situation is ironed out. However, there are a number of good transactions going through in machine tools and machinery. Among the buyers lately was the General Electric Co., which was in the market for some time for lathes for the big shops at Erie, Pa., while the Pennsylvania R.R. purchased a new forging machine for the shops at Pitcairn, near Pittsburgh. The Union Railroad, a local road used as a carrier between mills of the United States Steel Corp., was also on the order books of the jobbers for axle lathes and car wheel boring mills. A week or two ago it was reported that the Pennsylvania was in the market for considerable machine tool equipment at its Conway yards, but this buying seems to have been temporarily put aside while the company is buying equipment for its yards at Dennison, Ohio.

Notwithstanding the falling off in inquiries, the machine tool market is rather active. A local dealer sold a double-end punch and shear to a customer in Texas, and the same firm sent a 550-ft. air compressor with direct motor drive to a machine shop in Virginia. Word from Wheeling indicates that a large concern there is anxious to secure eight or ten tools, including boring mills, radial drilling machines, milling machines, grinding machines and lathes. One local user of shears who last week postponed delivery of new equipment changed front this week and is urging delivery and also asking for two other machines. There have been a few inquiries for cranes, but very little actual transaction has occurred in the market, which is featureless.

Many Unfilled Orders for Locomotives

Stockholders of the American Locomotive Co. at a special meeting approved the recent proposal of the Board of Directors to change the common stock capitalization of the company from 250,000 shares of $100 par value each to 500,000 shares of no par value and exchange two shares of the new stock for one of the old. The resolution contained a proviso that the capital with which the company should carry on business should at all times be not less than the amount of the preferred stock and $50 a share on the no par value common stock.

Andrew W. Fletcher, president of the company, told the stockholders that the company had unfilled orders on its books calling for the delivery of $60,000,000 worth of equipment, this being sufficient to keep the plants busy for the rest of the year.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE remarkable success of the Austrian Loan was the financial sensation of last week. The $25,000,000 offered in New York as well as the $50,000,000 brought out in London were heavily over-subscribed. The security is good and the rate attractive, but the psychological skill in publicity with which the flotation was managed sets a new standard of excellence and good taste in such matters and was largely responsible for the results secured.

There are many who believe that the apparent ease with which the issue was sold opens the way for an enormous German loan out of whose proceeds France can be paid enough to induce her to withdraw from the Ruhr.

This belief may be unduly or prematurely optimistic, but there is no doubt that the sale of the Austrian Bonds will quicken the desire of the Germans to go and do likewise, and that it will somewhat hasten the financial reconstruction of Europe. The continued progress of the mark toward zero confirms this impression for it is generally agreed that bankers will make its complete demonetization a condition precedent of any German loan. On last Friday one dollar would buy more than 108,000 marks, but the trading is small and the quotations are nominal.

Next in importance to the Austrian loan was the statement of our foreign trade for May. Exports were large, but imports continue to exceed them, the excess for May being $51,000,000. The "adverse" balance for the first five months of 1923 is $140,000,000. This is what everyone professed to expect and no one should be alarmed by it, but there are some who are disturbed because they think in terms of our pre-war experience as a debtor instead of a creditor nation.

But the fact that we can only collect a small portion of what is annually due us in gold and that the balance must be paid in goods or services is becoming better understood and the disposition to regard an adverse balance of trade with alarm is gradually passing.

As our "invisible" exports and imports, which include freights, insurance premiums, etc., can only be guessed at it is difficult to know when we are spending more abroad than we have coming to us there.

Current estimates of what Europe ought now to remit us annually range around $400,000,000, including the "invisible" items and Great Britain's payments on account of the interest and principal of her debt to us. Therefore until our excess of imports, plus additional loans to Europe and the $100,000,000 that our tourists are supposed to spend there exceed $400,000,000 annually a so-called adverse trade balance need give us no concern.

It simply indicates that we are collecting our debts in goods instead of in gold, which is to our advantage, for we have too much gold already.

But the astonishing thing about the present situation is that despite our excess of imports we continue to import gold. Last week the gold holdings of the Federal Reserve Banks increased by $25,600,000 and the reserve ratio rose from 75.7 to 77 per cent. This assures an abundance of credit, but it fosters the fear of inflation among some whose cautionary preachments continue to restrain speculation and deter merchants from stocking up.

> "But notwithstanding the lethargy of the raw material markets, the retail trade is good and jobbers report a steady distribution which is larger than it seems because the orders, though numerous, are for small quantities. . . . Generalizing with regard to the outlook it may, therefore, be said with confidence that it is good, that there is no distention anywhere and that business men are now justified in calculating upon normal conditions up to and through the Autumn and probably until the end of the year, which is about as far ahead as one can see even dimly through conditions that are without precedent in their complexity."

The consequence is what may be described as a suppression of activity in both the security and commodity markets. Early in the week the stock market, and especially the railway shares, were strong.

But just after the New York Central had announced a quarterly dividend at the rate of 7 per cent per annum, instead of 5 per cent as previously, a sharp reaction set in which carried the whole list downward despite trade, industrial and traffic reports which indicate a domestic prosperity that is almost unexampled.

In the commodity markets the tendency has also been reactionary. Wheat and corn have been hesitant at a slight decline. Cotton is off nearly a cent from the top because there is a fear that the next Government report may be inconsistent with private advices which show deterioration.

Sugar has declined quite sharply upon increased estimates of the Cuban crop and coffee is distinctly lower upon advices from Santos which allege "political trouble" in Brazil and the Government's abandonment of its valorization policy and purchases. In passing it may be in order to remark that at 7½ cents for delivery next March coffee is nearing the cost of production and that staples of universal consumption bought at or near that level are generally well bought.

Hogs and hog products, as well as cattle, are likewise lower. The supply of hogs is apparently enormous and the packers are complaining that the doctors are spoiling their market by advising people to eat less meat. One effect of the decline in lard has been a corresponding decline in cotton seed oil as a result of which an important group of cotton oil mills has been shut down indefinitely.

Some slackening in the demand for steel is also reported and at 15½ cents copper is about the only important staple that shows any advance for the week.

But notwithstanding the lethargy of the raw material markets the retail trade is good and the jobbers report a steady distribution which is larger than it seems because the orders though numerous are for small quantities.

In the cotton goods market some hesitancy has been caused by the wide publicity given to the so-called "shut down" of one or two important New England mills, but many Southern mills are running over time, the cotton consumption for May is surprisingly large and a desire to protect themselves against a demand for higher wages rather than inability to sell their goods probably explains the action of the New England manufacturers.

Generalizing with regard to the outlook it may, therefore, be said with confidence that it is good, that there is no distention anywhere and that business men are now justified in calculating upon normal conditions up to and through the Autumn and probably until the end of the year, which is about as far ahead as one can see even dimly through conditions that are without precedent in their complexity.

If this optimistic generalization be justified it may be wise for forward looking consumers of coal to consider the advisability of securing their supplies of fuel while the railroads are able to deliver it with promptitude.

By this it is not intended to suggest that higher prices for coal are or will be warranted. They are high enough now, but one way to keep them down is to be forehanded in buying so that the Winter's requirements can be mined and shipped during the dull months of the year when labor and transportation are relatively abundant.

Personals

W. J. McDOWELL has recently become connected with the Chicago office of the Buffalo Forge Co.

H. V. HOLMAN has recently become associated with the Monroe Machine Tool Co., Chicago, as treasurer and acting manager. The company makes special tools, jigs, and dies.

C. F. HELME for the past three years master mechanic of the Seneca division of the Lehigh Valley R.R. with offices in Sayre, Pa., has been transferred to Easton, Pa., to become master mechanic of the New Jersey and Lehigh division.

BENJAMIN RATHBUN, formerly with the Shepard Electric Crane & Hoist Co. of Montour Falls, N. Y., has accepted an executive position with the Chemung Foundry Co., Elmira, N. Y.

J. P. LAUX has been appointed shop superintendent of the Lehigh Valley shops at Sayre, Pa. He suceeds ANDREW MCGILL who has been appointed assistant superintendent of motive power.

J. L. DEBRE and E. LAMBERT of the Compagnie Generale d'Electricite, Paris, have recently completed a tour of the paper mills in northern New York.

J. H. WELKER has resigned as factory manager of the Herschell-Spillman Motor Co., North Tonawanda, N. Y., and has accepted the position as manufacturing manager with the Gray Motor Corp., Detroit, Mich.

W. H. TOWNSEND has been appointed sales manager of the Cleveland Duplex Machinery Co., Cleveland, Ohio. Mr. Townsend was formerly with the Automobile Screw Products Co. and the Atlas Bolt & Screw Co., both of Cleveland.

HARRY W. PAGE, for the past six years assistant manager of the B. F. Sturtevant Co., Hyde Park, Boston, Mass., has been appointed general manager of the new western works being established by the same company in the plant of the former Wisconsin Engine Co. at Corliss, Wis., which it has recently acquired.

HAROLD HEMENWAY, for five years vice-president and general manager of the Peoria Malleable Castings Co., Peoria, Ill., has accepted the position of general works manager of the new works at South Beloit, Wis., for the Wanner Malleable Iron Co., Hammond, Ind., that recently acquired the malleable shops of the Stewart-Warner Mfg. Co. E. M. Griswold has been transferred from Hammond to Beloit as assistant to Mr. Hemenway. Edward H. Lutton, formerly of the Peoria company, is in charge of the annealing department and labor division. E. J. Knight, of Beardstown, Ill., is production and office manager.

J. REGINALD STEBBINS has been elected president of the W. C. Stebbins Mill Supply Co., Watertown, N. Y.

HOWARD W. GILLETTE, for several years with the Rochester office of Ogden T. Adams Co., Inc., machinery and equipment, will take charge of the Syracuse office of the same firm.

DR. W. R. WHITNEY, director of the Research Laboratory of the General Electric Co., Schenectady, N. Y., was recently elected a member of the corporation of the Massachusetts Institute of Technology for a term of five years. He was graduated from M.I.T. in 1890 and has for some time been a nonresident professor of theoretical chemistry at the institution. Walter Humphreys, '97, of Brookline, and Charles R. Maine, '09, a prominent consulting engineer of Boston were also elected to the corporation, these three succeeding Paul W. Litchfield, Arthur D. Little and Eben S. Stevens.

CHARLES P. HERY has become associated with the Rochester office of the Ogden R. Adams Co., Inc., Rochester.

LEWIS S. EDGARTON, professor of metallurgy at Mechanics Institute, Rochester, has become associated with the Ogden R. Adams Co., Inc., Rochester. He will be in the Buffalo office.

FRED P. HILL, who has been in the automobile business in Atlanta, Ga., for the past ten years, has accepted a position as Southeastern manager for the Swedish Crucible Steel Co., of Detroit. A southern office covering seven states has been established at 210 Means St. in Atlanta.

F. H. WORTHINGTON, formerly at the Jacksonville, Fla., office of the General Electric Co., has been appointed local manager of the Jacksonville office to succeed G. C. Henry, recently resigned.

E. F. COOPER is in charge as Southern manager for Henry Disston & Sons, Inc., who have recently opened a Southern warehouse and sales headquarters at Atlanta, Georgia.

Obituary

WALTER H. JENNINGS, secretary and treasurer of the Murchey Machine & Tool Co., Detroit, Mich., died recently in Detroit following an illness of ten days. Mr. Jennings who was 48 years of age was prominent in both industrial and club life in the Michigan city.

HENRY N. SPENCER, president of the Howell Electric Motors Co., Howell, Mich., died recently at his home in that city. Mr. Spencer was at one time president of the Spencer-Smith Machine Co. of Howell.

CHARLES W. DAMBACKER, for many years connected with the Winchester Repeating Arms Co., the Dominion Cartridge Co. and other munitions concerns, and for thirteen years superintendent for the H. B. Smith Co., maker of boilers and heaters, Wesfield, Mass., died in his home in Westfield, June 5. He was 70 years old and had been retired for a number of years.

HENRY SOUTHWORTH SHAW, aged 90 years, died recently at his home in Milton, Mass. Mr. Shaw had been especially active in the machinery industry during his life time and was at one time president of the Saco & Pettee Machine Shop, the Saco-Lowell Machine Shops, the Eastern Machinery Co., and the Rhode Island Malleable Iron Works. In addition to these connections, Mr. Shaw served for some years as president of the Boston & Maine Railroad.

CHARLES E. THOMAS, aged 54 years, died recently at his home in Wilmington, Del. Mr. Thomas was with the sales department of the Hilles & Jones Co., a branch of the Consolidated Machine Tool Corp. He had formerly been with the Cleveland Punch & Shears Works Co., of Cleveland, Ohio, as general manager.

ERNEST G. ELDRIDGE, aged 43 years, died recently at his home in Galva, Ill. Mr. Eldridge for many years was identified with the machine tool industry having been connected with the Eccles & Smith Co., the E. L. Essley Machinery Co., and for some years in business for himself. Recently he had been living in California due to ill health.

OTTO F. KAESER, member of the Atlas Engineering Co., Milwaukee, concrete mixers, wagon loaders and conveyors, died June 10 after an illness of several months. He was born in 1876 in Suttgart, Germany, and came to America later as a graduate engineer, becoming associated with the Bucyrus Co., South Milwaukee, as a designing and production engineer. About two years ago he assisted in the establishment of the Atlas works.

Business Items

The machine shops of the Thomasville Iron Works, at Thomasville, Ga., destroyed recently at a loss of several thousand dollars, are being entire rebuilt, according to an announcement by C. L. Thompson, head of the company.

The plant of the Tallahassee Iron Works, at Tallahassee, Fla., including foundry and machine shops, is being rebuilt to replace the structure destroyed some time ago by fire at a loss of about $50,000, according to R. O. Collins, head of the company.

More than $100,000 is being invested at Waycross, Ga., by the Atlantic Coast Line Railroad Co., in improving and enlarging its repair and machine shops in that city, according to an announcement by J. A. Wall, superintendent of the division.

The T. L. Talbert Iron & Steel Co., formed recently at Charlotte, N. C., with $100,000 capital, is to construct at once a large plant in that city, according to T. L. Talbert, president and general manager.

A plant, including machine shops, is being established at 5th Ave. and 22nd St., Birmingham, Ala., by the Standard Manufacturing Co., of Pittsburgh, Pa., for the manufacture of plumbing fixtures. The Birmingham plant will supply the Southeastern trade.

At a recent sale held of the Seneca Falls Manufacturing Co., Seneca Falls, N. Y., no bid was accepted by the receivers, William S. McGreevy and Kenneth H. Bartlett. It is expected that another sale will be held within the near future.

The Columbia Steel & Shafting Co., of Pittsburgh, has purchased the entire stock of shafting and machinery for manufacturing the same from the Brightman Manufacturing Co., of Columbus, Ohio. The last named company will devote its energies in the future to the manufacture of nuts and shafting machinery. In its machinery department more time will be given to the development of the equipment for finishing bar stock and tubing.

The plant of the Ware Foundry Co. at Ware, Mass., was almost completely destroyed by fire of undetermined origin on June 8. Valuable patterns and products partially finished were lost along with buildings and machinery. The concern, which did much work for textile mills, had a serious fire only three years ago, following which new equipment was installed.

Approximately 50 sales representatives attended the annual sales convention of the Buffalo Forge Co. at Buffalo the week of June 18-23, coming from all sections of the United States. Sales work of the previous year was gone over and plans and announcements made for the year ahead.

R. L. Barker & Co., Chicago, have been appointed exclusive representatives for the Hisey, Wolf Machine Co., Cincinnati, for the states of Indiana, Illinois, Wisconsin and Iowa.

The Polly Mfg. Co., 431 Chestnut St., Milwaukee, Wis., manufacturer of lighting fixtures and art metal products, has changed its corporate title to Polly Lane, Inc. H. S. Polacheck is secretary.

The Fairbanks-Morse Co. will represent the Oliver Machinery Co., Grand Rapids, Mich., in the Dominion of Canada.

The name of the Presto Phono Parts Corp., Brooklyn, has been changed to the Presto Machine Products, Co., Inc. Larger quarters have also been taken by this company at 70-80 Washington Street.

The name of the Electric Steel Co., Chicago, Ill., has been changed to the Nugent Steel Castings Co. There has been no change in the management, personnel or ownership, however.

Rules Against Kansas Industrial Court

The Kansas Industrial Relations Act received a heavy blow when the Supreme Court in an unanimous opinion, delivered by Chief Justice Taft, declared that the Kansas tribunal was without power to fix wages in the plant of the Charles Wolff Packing Co. The Chief Justice stated that the act creating the Industrial Court conflicted with he Fourteenth Amendment of the Constitution.

It was contended for the Kansas tribunal that the latter's ruling was justified by the fact that a strike in one establishment might spread, thus affecting the public interest Chief Justice Taft found that whether such danger existed was, under the law, to be determined by a subordinate agency "and on its findings and prophecy, owners and employers are to be deprived of freedom of contract and workers of a most important element of their freedom of labor."

Howard Evans Is Honored By Foundry Men

Members of the Philadelphia Foundrymen's Association tendered to Howard Evans the secretary for many years, a dinner at the Manufacturers' Club on June 13. The dinner was exceptionally well attended and many were the expressions of good-will toward Mr. Evans.

The success of the dinner was due particularly to the efforts of the committee which included: Frank Krug, C. R. Spare, R. R. Belleville, Walter T. McDonald and W. G. Summers. President Frederick M. Devlin acted as toastmaster and Mr. Evans was presented with a remembrance of the occasion.

Reed-Prentice Co. Makes Personnel Changes

Several changes have taken place among the officials of the Reed-Prentice Co., Worcester, Mass., since it took over the Becker Milling Machine Co. (of Hyde Park, Mass., and J. Verner Critchley succeeded Arthur H. Wood of Boston as president. Frank O. Hoagland, for several years general manager, has resigned to accept a position in the mechanical department of the Saco-Lowell Shops, Boston, and President Critchley will take over his duties.

Frederick W. McIntyre, a native of Boston, general sales manager, formerly with the Becker Milling Machine Co., has been made assistant to the president, and William T. Cowell, former assistant works manager of the Lodge & Shipley Machine Tool Co., of Cincinnati, has been appointed works manager.

The company has orders to permit of a 100 per cent basis of production, but inability to secure skilled labor at present prevents it. The company is operating with 500 men, part of them working overtime, and the force is being increased as rapidly as mechanics become available.

Catalogs Wanted

Catalogs with prices of machines and tools for the production, grinding and engraving of fine glass products manufactured in Brazil. Catalogs may be sent to Ricardo A. Raszl, 385 West St., New York City.

Trade Catalogs

Chucking and Turning Machines. The Bullard Machine Tool Co., Bridgeport, Conn. The 18-in. continuous chucking and turning machine made by this company is described in a booklet issued recently. The machine is specifically developed for the machining of flywheels and adapted to a wide variety of boring, turning and facing operations on other work.

Extra Equipment. The Universal Boring Machine Co., Hudson, Mass. A folder issued by this company illustrates and describes extra equipment manufactured by it in the way of auxiliary tables, boring heads, facing heads, boring bars, milling cutters, and levels, to be used in connection with boring machines or operations.

The Malleabilizing of Iron Castings. The Brown Instrument Co., Philadelphia, Pa. Data pertaining to the making of malleable castings and to annealing ovens is to be found in the booklet that has been issued by this company.

Ball Bearing Hangers and Transmission Appliances. SKF Industries, Inc., New York. The superiority of ball bearings over other bearings is stressed in the catalog recently issued by this concern. In the form of a questionnaire, many pertinent questions are asked and answered at the beginning of the booklet. Comparison pictures, diagrams, charts and tables of specifications besides illuminating text are to be found in the catalog.

Hammer Crushers. Pennsylvania Crusher Co., Philadelphia, Pa. Various crushers for cement, rock and limestone are described and illustrated in a booklet issued by this company. Specifications are also included in tables and charts.

Automatic Surface Grinding Machines. Williams, White & Co., Moline, Ill. Machines to remove comparatively large quantities of metal from the rough without preliminary cutting operations are shown in a catalog that has been issued by this firm. Parts are also shown in the booklet.

Thread Grinding Machines. The Precision & Thread Grinder Manufacturing Co., Philadelphia, Pa. Grinding machines to produce threading tools such as taps, dies, gages, hobs and chasers are shown in the new handbook that has been issued by this company. Valuable engineering data is also included in the book.

Twist Drills, Reamers, Taps, Milling Cutters and Drill Chucks. The Standard Tool Co., Cleveland, Ohio. Catalog 25-B has been issued by this company. It contains 371 pages; is divided and indexed by the various subjects, and also contains many excellent tables and formulas.

Water Softeners. Graver Corp., East Chicago, Ind. A booklet putting forth the merits of two water softening systems has been issued by this company.

Hoists. The Sullivan Machinery Co., Chicago, Ill. Bulletins 76-C and 76-D have been issued by this company. In the first is described the Sullivan "Turbinair" hoist single drum, type "HA" and in the second is to be found data on the Sullivan "Turbinair" hoise double drum, type "HDA." Both bulletins are perforated on the left side for filing purposes.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engine, semi-Diesel. Belize, British Honduras. Agency. Reference No. 6783.

Industrial machinery. Philippopolis, Bulgaria. Agency. Reference No. 6725.

Paper-making machinery. Melbourne, Australia. Purchase. Reference No. 678.

Wheels and axles for mine trucks. Johannesburg, South Africa. Purchase and agency. Reference No. 6718.

Forthcoming Meetings

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

American Society for Testing Materials. Annual meeting at Atlantic City, June 25 to 29, Chalfonte-Haddon Hall. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

Section V Mechanical of the American Railway Association. Annual meeting at Orchestra Hall, Chicago, June 20, 21 and 22. V. R. Hawthorne, 431 South Dearborn St., Chicago, secretary.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Copper buying movement in full swing; price up ¼c. per lb. in New York during week. No other advances reported.

Declines—Pig-iron buying in small lots only; market quietest in 1923; prices unchanged. Steel prices tending toward lower levels. Greatest weakness in steel sheets and reinforcing bars. Quotations as low as $2.35 per 100 lb. offered on bars at Pittsburgh mill; maximum $2.40. New demand for plates and shapes improved; quotations mainly at $2.50 per 100 lb., f.o.b. mill, with $2.60 asked for immediate shipment. Blue annealed steel sheets down 15c.; black and galvanized, 10c. per 100 lb., in Cleveland. Tin showing downward trend; dropped 1¼c. per lb. in New York during week. Tone of the lead market easier. Zinc dropped ¼c. per lb. owing to increase in supply. Antimony also dull. Zinc sheets, solder and babbitt metal lower on account of recent decline in non-ferrous metals. Raw linseed oil (5 bbl. lot), $1.27 per gal. in Cleveland as against $1.30, one week ago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31 55
Northern Basic	30 77
Southern Ohio No. 2	31.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36 75
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.26
Virginia No. 2	34.17
Basic	28.26
Grey Forge	28.76
CHICAGO	
No. 2 Foundry local	32.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	30.77
Basic	29 27
Bessemer	30.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.50
Cleveland	5.60@6.25
Cincinnati	6.75
New York	5.50@5.75
Chicago	4 00@5.00

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.95	4.45	4.85
Nos. 22 and 24.	3.75	5 00	4.50	4.85
Nos. 25 and 26.	3.80	5 05	4.55	4.90
No. 28	3.85	5 15	4.65	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00	5.15	4.70	5.10
Nos. 12 and 14.	4.10	5.25	4.80	5.20
Nos. 17 and 21.	4.40	5.55	5.10	....
Nos. 22 and 24.	4.55	5.70	5.25	5.65
No. 26	4.70	5.85	5.50	5.80
No. 28	5.00	6.15	5.80	6.10

WROUGHT PIPE—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	62	50½	¾ to 1½	30	13
		LAP WELD			
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	60	49½	¾ to 1½	30	14
2 and 3	61	50½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50@8.00	8.00	7.35
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.30
Cold finished flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.32½
Soft steel bar shapes (base)	3.54	3.36	3.32½
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.71	3.40
Bar iron (3.25 at mill)	3.54	3.36	3.32½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%
Electric welding wire:			
5/32	8.50		14.00
1/8	7.35		12.25
5/32 to ¼	7.10		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.87½
Tin, 5-ton lots, New York			42.12½
Lead (up to carlots), St. Louis	6.95;	New York,	7.62½
Zinc (up to carlots), St. Louis	6.10;	New York,	6.55

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	28.50
Antimony (Chinese), ton spot	7.87½	10.50	8.75
Copper sheets, base	25.25	24.25	23.00
Copper wire (l.c.l.)	18.12½	21.00	16.25
Copper bars (l.c.l.)	22.50	24.25	19.50
Copper tubing (l.c.l.)	27.00	29.25	23.00
Brass sheets (l.c.l.)	20.50	24.25	18.75
Brass tubing (l.c.l.)	25.50	29.75	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (l. c. l.)	18.75	21.00	15.75
Brass wire (l. c. l.)	21.00	22.00	.....
Zinc sheets (casks)	10.25	10.40	.....
Solder (½ and ½), (caselots)	31.50	29.50@31.50	20.00
Babbitt metal (83% tin)	56.00	52.00	41.00
Babbitt metal (35% tin)	30.00	17.50	18.00
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	35 00
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	13.00	14 00
Copper, heavy, and wire	13.25@13.75	12.00	13 00
Copper, light, and bottoms	11.25@11.75	10.00	12.00
Lead, heavy	5.00@ 5.50	5.00	6.25
Lead, tea	4.50@ 4.75	4.00	5.25
Brass, heavy, yellow	7.50@ 7.75	....	8.50
Brass, heavy, red	11.00@11.50	10.00	10.50
Brass, light	6.00@ 6.50	5.50	7.00
No. 1 yellow brass turnings	7.50@ 7.75	6.50	7.75
Zinc	3 75@ 4 25	3.00	4.25

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
IX,	20x28, 112 sheets	26.00	22.25	20.90
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
IX,	20x28, 112 sheets	23.50	19.75	19.60
Coke Plates				
Primes, 20x28 in.:				
100-lb.,	112 sheets	14.00	12.60	14.50
IC,	112 sheets	14.30	13.00	14.80
Terne Plates				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	8.00	6.65	7.25
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13½x13½, per lb.	11.25	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	3.50	2.65
Roll sulphur, per 100 lb	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.16	1.27	1.37
White lead, dry or in oil	100 lb. kegs.	New York,	14.50
Red lead, dry	100 lb. kegs.	New York,	14.50
Red lead, in oil	100 lb. kegs.	New York,	16.00
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.50@5.25	
Coke, prompt foundry, Connellsville	per net ton	6.00@7.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 9/16 and smaller	60%	.....	...
Semi-finished nuts, ⅝ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

D. C., Wash.—Milor & Homan, 1627 K St.—machine shop equipment, including lathe, grinder, press, etc., for complete service station at Mt. Rainier, Md.

Kan., Belle Plaine—E. L. Neptune (blacksmith)—power metal lathe and cylinder grinder (used).

Kan., Belle Plaine—J. T. Oley (garage)—power drill press, power lathe, cylinder grinder, belting, hangers, pulleys, shafting, emery wheel and stand.

Kan., Belle Plaine — J. A. Owen (saw mill and machine shop)—power drill press and power metal lathe (used preferred).

Kan., Madison—H. Colton (machine shop)—one 16 in. and one 18 in. lathe, quick change.

Mass., Boston—Chamberlain Garage, Inc., c/o L. Joselyn, Archt., 339 Newbury St.—complete machinery and equipment for proposed $250,000 garage and machine shop.

Mass., Boston—Donavan Motor Car Co., 626 Commonwealth Ave.—several bench tools, including vises, upright drill, hand drills, various sizes of drills and reamers, also miscellaneous small tools for automobile repair shop.

Mass., Brookline (Boston P. O.)—W. E. Delorey, Webster St.—machinery, including small lathe, planer, upright drill, pulleys, shafting and miscellaneous small tools for machine shop.

Mass., Middleboro—The town—machine tools for manual training department of proposed $225,000 high school.

Mass., Monson—Rubwood Wheel, Inc., c/o H. N. Atwood—machinery and machine tools for proposed $60,000 factory for the manufacture of automobile wheels.

Mich., Detroit—Jorgensen Mfg. Co., 122 West Jefferson Ave.—14 or 16 in. lathe, 20 in. drill press, No. 0 Rockford milling machine, etc., (used).

Mo., Kansas City—Crago Gear & Machine Wks., 1416 Walnut St., A. Crago, Purch. Agt.—job shop machine to cut bevel gears up to 28 in., automatic, belt or motor driven (No. 1 rebuilt or new).

Mo., North Kansas City—Stewart-Drake Corp., 14th and Holmes Sts.—power boring machine.

Mo., St. Louis—J. Brussel, 4410 Grace Ave.—lathes, jacks, emery wheels, etc., for automobile repair shop at 1304-8 North Market St.

Mo., St. Louis — Northwestern Brass Fdry. Co., 2019 North Bway.—1½ or 2 in. stroke, 750 lb. fly wheel punch press.

N. Y., Binghamton—Marion Garage, 465 State St., F. J. Marion, Purch. Agt.—4 x 4 in. power operated metal saw.

N. Y., Boonville—Lester-Gardner Motor Co., R. J. Lester, Purch. Agt.—drill press for motor repair (new or used).

N. Y., Buffalo—Ross Heater & Mfg. Co., 1407 West Ave. (heating and ventilating), S. C. Ross, Purch. Agt.—equipment for proposed $12,000 machine shop.

N. Y., Jamestown—Crescent Tool Co., Harrison St. and Foote Ave. (manufacturer of wrenches)—presses, packing equipment, also pickling (sulphuric acid) machinery and equipment.

N. Y., Malone—T. Hinds Co., 107 Catherine St. (machine shop and foundry), J. B. Hinds, Purch. Agt.—20 in. vertical post drill and high speed twist drills.

N. Y., New York—Novo Tool Co., 758 Whitlock Ave.—several punch presses.

N. Y., Rochester — New York Canners, Inc., 75 State St.—machine shop equipment, also canning machinery and equipment for proposed $90,000 factory.

N. Y., Sacket Harbor—B. J. Scroxton, Main St. (plumbing, steam fitting, etc.)—one 220 volt portable electric drill with grinding attachments.

N. Y., Utica—C. Sautter, 14 Genesee St.—complete equipment for 2 story machine shop.

O., Chillicothe—Buckeye Tile Co., E. J. Hydell, Genl. Mgr.—complete machine shop equipment, including lathe, press, drill, etc.; also tile making machinery.

O., Columbus—Arch City Machine Wks., Vine and Market Sts., C. L. Malnicke, proprietor—equipment for general machine shop, including one 24 in. lathe and one milling machine.

O., Columbus—W. H. Dailey, 437 South 3rd St. (tinner and cooper)—metal working machinery to enlarge shop.

O., Columbus—Eaton Machine Wks., 37 Scioto St. (manufacturer of elevator machinery), M. Sylvester, Purch. Agt.—one shaper and one small lathe.

O., Nelsonville—D. L. Wallace—foundry and machine shop equipment, including lathe, press, drills, etc.

O., Youngstown—Van Baalen Auto Co., Wick and Maple Sts.—garage, machine and repair shop equipment, including drill, press, etc.

Okla., Enid—J. Johnson, 103 West Cherokee St.—power metal quick change lathe for machine shop.

Okla., Enid — Sturdevant Sheet Metal Co., 405 South Grand St.—power metal lathe and power metal drill press.

Pa., Scranton—L. J. Bour Refractories Co., Moosic St. (manufacturer of cement, motors, etc.)—$10,000 worth of grinders and equipment.

Va., Richmond—M. H. Bolton, 1840 West Broad St.—cylinder grinder for automatic repair.

Va., Richmond—G. B. Branum, 2110 M St. (wheelwright)—drill press, up setter and tire bender.

Va., Richmond—A. H. Hall, 1623 West Broad St.—motor driven shaper for automobile repair work.

Va., Richmond—C. W. Shelsbridge, Meadow and Marshall Sts.—drill press for automobile repair shop.

Va., Richmond—Supreme Motor Repair Shop, 1639 West Broad St.—lathe and burning-in machine.

Va., Richmond—Tractor & Mchy. Sales Co., 1631 West Broad St.—drill press, emery wheel and stand for repair work.

Va., Richmond—L. Wiltshire, 1649 West Broad St.—lathe and drill press for automobile repair.

Wash., Seattle — Alaskan Eng. Comn., Purchasing Agent—receiving bids until June 25 for one 1½ cu.yd. clamshell bucket, one 24 in. shaper with motor and two 16 in., motor driven, heavy duty lathes.

Wis., Appleton—Valley Automobile Co., 726 College Ave.—repair shop equipment, also air compressor for proposed $60,000 garage.

Wis., Gillett — Miller & Rehme, c/o E. Rehme—acetylene welding equipment and drill press for proposed $30,000 machine shop.

Wis., Manitowoc—Invincible Metal Furniture Co., 26th and Franklin Sts.—punches, shearing machinery, belting and shafting for proposed punch shop.

Wis., Milwaukee—B. F. Eslien, 3707 Center St.—large and small drill presses, 10 ft. brakes, seaming machines and beaders for sheet metal works.

Wis., Milwaukee—A. Jensen, 1105 11th St.—8 ft. brake, bender, rolls and small tools for sheet metal works.

Wis., Milwaukee — A. O. Smith Corp., 27th St. and Keefe Ave. (manufacturer of pressed steel auto bodies), L. R. Smith, Pres.—automatic screw machines and large drilling machines.

Wis., Racine—F. Applegate, 1043 Washington Ave.—small tools, air compressor, gasoline storage tank and pump for proposed $60,000 garage.

Wis., Racine — Nelson Bros. & Strom, 3021 Washington Ave.—machine tool equipment, including milling machine and small tools, to produce dies, jigs, fixtures and moulds for rubber industry.

Machinery Wanted

Calif., La Jolla—La Jolla Light (newspaper)—power paper cutter, 26 in. or over.

Calif., San Jose—Merritt Concrete Products Co., 727 Chapman St.—concrete block making machinery and equipment for new $50,000 plant on Monterey Rd.

Conn., Plainville—Bd. Educ., L. S. Mills, Chn.—manual training equipment, including planer, band and circular saws, tables, benches, pulleys, belting, shafting, etc., for new high school.

Ga., Hamilton — T. M. Walker—brick making machinery and equipment.

Ill., Arthur—Home Oil Co., F. C. Phillips, Mgr.—machinery and equipment, including pumps, etc., for oil storage and distribution station.

Ill., Dixon—Reynolds Wire Screen Co.—machinery and equipment for addition to plant for the manufacture of wire screen and products.

Ill., Morrison—Shawyer Printing Co.—Miller Universal saw trimmer; power folding machine for a 26 x 40 in. sheet or a book folder, same size.

Ind., Columbus—Columbus Wood Turning Co. (manufacturer of small wood handles)—woodworking machinery and equipment, to replace that which was destroyed by fire.

Ind., Ellettsville—A. J. Thompson Stone Co.—double stone planer, screw or worm and rack power drive.

Ind., Indianapolis—C. F. Pritchard, 13th and Collins Sts.—concrete block making machines.

Kan., Belle Plaine — W. Rafferty (shoe maker)—leather stitcher for power equipment.

Kan., Herrington—Herrington Sun—saw trimmer (used).

Kan., Kansas City—Kansas City Refinery Sales Co., 2nd St. and Troupe Ave. (oil and gasoline), A. Martin, Purch. Agt.—filtering equipment.

Ky., Frankfort — Bd. Educ. — manual training equipment for proposed $100,000 high school.

Ky., Louisville—Marine Hospital, Treasury Dept.—laundry equipment.

Me., Milford—Barker Lumber & Box Co.—several circular and band saws, various sizes, also shafting, belting, etc., possibly planer and matcher.

Me., Sanford—Goodal Worsted Co.—machinery, shafting, belting and pulleys for woolen mill.

Md., Elkton—Cecil County School Bd.—vocational equipment, including lathe, drill, press, transmission and conveying machinery, also other machine tools for new $150,000 school.

Mass., Cambridge — Essex Brass Fdry. Co., A. Morang, Mgr.—complete foundry equipment.

Mass., Dorchester (Boston P. O.)—Harrison Square Fdry. Co., 110 Gibson St.—exhaust blower with about 20 in. inlet and outlet (used), also belting, pulleys and shafting.

Mass., Hubbardston — Hubbardston Woolen Mills, S. H. Inman, Mgr.—picking, carding, warping machines, pulleys, belting and shafting for mill, to replace that which was destroyed by fire.

Mass., Ware—F. W. Rindge, Chn. of School Com.—lathe, planer, matcher, bandsaw, tables and benches for proposed $150,000 high school.

Mass., Ware — Ware Fdry. Co., F. G. Quinn, Mgr.—foundry equipment, to replace that which was destroyed by fire.

Mass., Williamstown—Bd. Educ.—machinery, including planer, saws, tables, benches, pulleys, shafting, small tools, etc., for manual training department of new high school.

Mass., Worcester—Rice, Barton & Fales Machine & Iron Co., Taintor St.—about $10,000 worth of machinery, forge and foundry equipment.

Mass., Worcester—Worsted Textile Co., Hope Ave.—picking, carding machinery, etc., for addition to mill.

Mich., Detroit—Hupp Motor Car Corp., 3501 East Milwaukee Ave.—5, 10 and 25 ton cranes for proposed $500,000 addition to factory.

Minn., Pelican Rapids—H. E. Frazee—machinery and equipment for proposed grain elevator and feed mill.

Miss., Bay St. Louis—Bd. Educ.—complete vocational equipment for $100,000 school.

Miss., Laurel—Laurels Compress Co., D. Granberry, Pres.—cotton pressing machinery and equipment.

Miss., Meridian—Meridian Fiber Co.—machinery and equipment for proposed $50,000 addition to fiber plant.

Mo., Kansas City—Carrothers Co., 310 Walsix Bldg. (stone cutter)—air compressor and jack hammer for quarry work.

Mo., St. Louis—St. Louis Coffin Co., 1821 Chouteau Ave., F. W. Gardener, Pres.—small woodworking machinery.

Mo., Steele—The Enterprise—linotype and intertype.

Mo., Vandalia—The Leader—model 14 linotype.

Mont., Billings—Wells-Williams Printing Co.—power paper cutter and job printing press folder.

Neb., Gordon—Bd. Educ.—vocational equipment for $110,000 school.

N. Y., Batavia—Batavia Gypsolite Co.—complete machinery and equipment for two dry kilns, each 120 ft. long.

N. Y., Big Flats—Voight Bros.—set of large platform scales.

N. Y., Buffalo—Standard Oil Co. of New York, 1103 Elk St.—complete machinery and equipment for proposed gasoline and oil supply station at Tonawanda.

N. Y., Chestnut Ridge (Sacket Harbor P. O.)—R. S. Sprague (dairy products)—one 160 lb. air compressor with tank and piping, also one power operated grindstone.

N. Y., Dunkirk—Federal Bakery, Main St.—bakeshop equipment, to replace that which was destroyed by fire.

N. Y., Jamestown — F. O. Bryan, Genl. Mgr., 35 11th St.—machinery and equipment for factory for the manufacture of patented garter and coatless suspender, on 8th and Monroe Sts.

N. Y., Jamestown—Jamestown Worsted Mills, Harrison St.—complete textile machinery and equipment (new).

N. Y., Jamestown—Union Furniture Co., Crescent St.—complete machinery and equipment for dry kiln.

N. Y., Johnsonville—L. B. Brocket Lumber Co.—double side planer.

N. Y., LeRoy—Union Explosives Co.—machinery and equipment for the manufacture of explosives, to replace that which was destroyed by explosion.

N. Y., Millport — C. E. Breitwiser—one tire binding machine.

N. Y., New York—H. Allison, 1922 Park Ave.—rolls for rolling mill.

N. Y., Niagara Falls — International Paper Co., Buffalo Ave.—machinery and equipment for addition to paper mill.

N. Y., Owego—C. A. Buffington Mfg. Co., R. G. Geller, Purch. Agt.—woodworking machinery and equipment, also special machinery for the manufacture of folding metal bound wooden chairs.

N. Y., Red Hook—Bd. Educ.—complete vocational equipment for $200,000 school.

N. Y., Rochester—G. J. Gillies Corp., 268 State St.—platen style cutting machine, also creasing machine.

N. Y., Sacket Harbor—L. P. Hazlewood, Bedford Gardens (dairy products and farm)—two 1½ ton triple geared chain hoists with travelers and 250 ft. track.

N. Y., Salamanca — Ashworth-Odell Worsted Co., 296 Rochester St.—complete textile machinery and equipment, including looms, spindles, setters, etc., for large plant at Erie, Pa

N. Y., Sherburne—Bd Educ.—vocational equipment, including lathe, drill, press, transmission and conveying machinery, etc., for $125,000 school.

N. C., Murphy—Bd. Educ.—complete vocational equipment for $100,000 school.

O., Bellaire—Bellaire Enameling Co.—presses, also enameling machinery and equipment.

O., Columbus—Columbus Beveling & Silvering Co., 278 North 3rd St., E. A. Hill, Genl. Mgr.—glass beveling machinery.

O., Hamilton—Champion Coated Paper Co.—paper making machinery and equipment.

O., Marysville—United States Lumber & Mfg. Co., A. C. Uhll, Genl. Mgr.—woodworking machinery for large plant.

O., Piqua—L. Meyer, Pres.—paper box making machines.

O., Ravenna—W. Sirdevan (job printer)—power paper cutter, power lead and rule cutter, mitering machine and two numbering machines.

Okla., Enid—O. K. Shoe Shop, 222 Grand St.—power leather stitcher.

Okla., Sand Springs—Sand Springs Cotton Mill Co.—looms, spindles and other machinery and equipment for 27,000 spindle cotton mill.

Okla., Wakita—A W. Hufford—newspaper press, power job press and power paper cutter.

Pa., Coplay—Bd. Educ.—complete vocational equipment, including lathe, drill, press and other machine tools.

Pa., Corry—Corry Jamestown Mfg. Co., D. A. Hillstrom, Pres.—complete machinery and equipment for the manufacture of metal furniture.

Pa., Ebensburg — Gardner Calculating Machine Co.—machinery and equipment for proposed addition to plant.

Pa., Erie—Amer. Sterlizer Co.—deep gap press, weight about 3,800 lb.

Pa., Freeland—Eagle Paper Mills—additional paper making machinery and equipment.

Pa., Glenside—Abington Twp. School Bd.—complete manual training equipment, including transmission machinery, lathe, press, drill, saws, machine tools, etc.

Pa., Greensburg—H. Dreistadt, Pennsylvania R.R. Sta.—air compressor outfit for garage.

Pa., Huntingdon—Baker Printing Office, 509 Penn St.—power job press and stitcher.

Pa., Larksville (Wilkes-Barre P. O.)—Bd. Educ.—complete vocational equipment for $125,000 school.

Pa., Lititz—The Grade, Box 339 (job printer and newspaper)—saw trimmer, 19 in. advance cutter and multiple punch.

Pa., Neffsville — Bd. Educ. — vocational equipment, including lathe, drill, press and other machine tools for $115,000 school.

Pa., New Castle—Sieberling Rubber Co.—tire building machinery and equipment to increase capacity of plant from 800 to 3,000 cord tires per day.

Pa., Phila.—W. & G. Sales Co., 148 North 4th St. (job printers)—10 x 15 in. Chandler & Price power job printing press.

Pa., Scranton — Woodlawn Farm Dairy Co., 429 North Main Ave.—machinery and equipment for addition to plant.

Pa., Sharon—C. C. Weaver, 364 Lafayette Ave.—machinery, tools and equipment for carpenter shop.

Pa., Washington—Beaver Refining Co.—complete machinery, tools and equipment for proposed $500,000 oil refinery, to replace that which was destroyed by fire.

S. C., Sumter—O. L. Williams Veneer Co.—complete machinery and equipment for $500,000 veneer mill.

Tenn., Cookeville—Maxwell Hill Co.—ice and cold storage machinery and equipment.

Tenn., St. Elmo—G. S. Elder—rock crushing machinery and equipment.

Tex., Dallas — Farmer & Drake, 2326 Live Oak St.—two Chandler & Price job presses for power equipment.

Tex., Fort Worth—T. C. Shivers, 1104 Elmwood Ave.—newspaper press (used).

Tex., Graford—Bd. Educ.—vocational equipment for $90,000 school.

Tex., Paris—The Woodworker, Box 523—Universal woodworker, either Crescent, Famous or Buffalo.

Tex., Polytechnic (Fort Worth P. O.)—Stewart the Printer, 1515 Vaughn St.—23 in. power paper cutter, stapler and punch for power equipment.

Tex., Sinton—J. Chapple, Box 84—power gin.

Va., Danville—A. B. Clement, Room 205, Masonic Temple—linotype, intertype, cylinder press and 25 x 38 in. power job press, either Miehle or Optimus.

Va., Danville—Danville Printing Co.—25 x 38 in., 2 revolution press with register.

Va., Fredericksburg—Peerless Mfg. Co.—machinery and equipment for 1 story factory for the manufacture of surveying instruments.

Va., Lynchburg—Smith Mfg. Co., R. L. Smith, Pres.—metal working machinery and equipment for the manufacture of kitchen utensils.

Va., Richmond — Hackley Morrison Co., Inc., 1708 Lewis St. (machinery dealer)—one 12 x 14 belt driven air compressor (used preferred).

Va., Roanoke—Knott Coal Corp.—equipment for new mines near Whitesburg, Ky.

W. Va., Dunbar—Bd. Educ.—vocational equipment for $90,000 school.

W. Va., Wheeling—West Virginia Match Co.—machinery and equipment for proposed $300,000 factory for the manufacture of matches.

Wis., Ashland—Ashland Paper Co., M. C. Connors, Mgr.—hoisting and conveying machinery, pulp machine, beater, belting and shafting.

Wis., Bear Creek — Flanagan Bros., A. Flanagan, Mgr.—equipment, belting and shafting for proposed pickle factory at Tigerton.

Wis., Burlington — Wisconsin Sanitary Milk Co.—special dairy machinery for proposed $40,000 addition to condensery.

Wis., Eagle River—C. A. Thompson—gasoline storage tanks and pumps for proposed filling station.

Wis., La Crosse—Ideal Wet Wash Laundry, c/o G. H. Gordon, 311 Main St.—extractors, mangles, washers, dryers, etc.

Wis., Madison—Heilprin Fruit Co., West Mifflin and Bedford Sts., J. Heilprin, Pres.—large ice machine, belting, shafting and refrigeration machinery for cold storage warehouse.

Wis., Madison—Madison Auditorium Co., 119 East Washington Ave., C. F. Ellis, Mgr.—belting, shafting, ash handling machinery and equipment for proposed $100,000 heating plant.

Wis., Manitowoc—Clark Oil Co., 10th St. and York Ave.—gasoline storage tanks, pumps and free air equipment for proposed filling station.

Wis., Manitowoc — Manitowoc Portland Cement Co., c/o L. E. Geer, 16th and River Sts.—kiln equipment, mixers, belting, shafting, etc., for proposed $1,000,000 cement mill.

Wis., Medford—A. C. Haight—gasoline storage tanks and pumps for proposed filling station.

Wis., Merrill—Ideal Co-Operative Creamery Co.—dairy and refrigeration machinery, belting and shafting for proposed cheese factory.

Wis., Milwaukee—A. Goese, 322 Garfield Ave.—one 8 x 12 in. or larger printing press.

Wis., Milwaukee — Lighthouse Superintendent, Federal Bldg., N. M. Works, Purch. Agt.—one large air compressor with oil engine.

Wis., Milwaukee—Milwaukee Paint & Varnish Wks., 1523 Holton St.—paint making machinery, including mills, mixers, belting and shafting.

Wis., Milwaukee—Modern Auto Repair Co., 2431 State St.—air compressor, gasoline tank and pump for proposed addition to garage.

Wis., Milwaukee—Western Ice & Coal Co., 601 Security Bldg., R. Werner, Purch. Agt.—ice making machinery.

Wis., New London—M. J. Heinz—vulcanizing equipment for proposed $40,000 shop.

Wis., Ripon—Ripon Produce Co.—creamery machinery, belting and shafting for proposed $40,000 plant at Stetsonville.

Wis., Seymour—M. G. Hollada—refrigeration machinery, motor driven.

Wis., Whitewater—Whitewater Constr. Co.—rock crushing machinery with elevator and conveyors (used preferred).

Alta., Lethbridge—Dominion Refineries, Ltd.—complete equipment for 300 bbl. refinery.

Man., Winnepeg—Lake of the Woods Milling Co., 212 McDermott Ave., W. Hutchinson, Vice Pres. — additional flour milling machinery to increase output from 1,400 to 2,000 bbl. per day and additional elevating machinery to increase capacity from 100,000 to 200,000 bu. for plant at Medicine Hat, Alta.; additional flour milling machinery for plant at Keewatin, Ont.

N. S., Cape Breton—Malan Coal Co.—complete coal mining equipment.

Ont., Ford—Ford Motor Co. of Canada—coal conveyors, pulverizers and ash handling equipment for proposed power house.

Ont., Matawachan—British Matawatchan Gold Mines, Ltd.—machinery and equipment for extensive development.

Ont., Toronto—Davidson Gold Mines, Ltd., King Edward Hotel Bldg., J. C. Platt, Secy.—stamps, crushers, drills and air equipment, electrically driven, for proposed extension to gold mining mill.

T. H., Pearl Harbor—Bureau of Yards & Docks, Navy Dept., Wash., D. C.—receiving bids until July 18 for a 1 ton electric crane for Naval Operating Base.

Metal Working Shops

Calif., Petaluma—The Sausalito-Petaluma & Santa Rosa Stage Co., c/o W. H. Curtis, et al., 339 College Ave., Santa Rosa, plans to build a 1 story automobile stage depot on A and 4th Sts., here. Estimated cost $40,000. Engineer or architect not selected.

Calif., Sacramento—The Western Pacific R.R. Co., Mills Bldg., San Francisco, awarded the contract for the construction of additions to its Jeffrey shops, here. Estimated cost $100,000. Noted June 7.

Calif., San Francisco—O'Brien Bros., Inc., Archts., 315 Montgomery St., are receiving bids for the construction of a 1 story (ultimately 4 story) garage on Eddy St. near Hyde St. for L. W. Allen, c/o Architect.

Fla., Miami—The L. D. Shackleford Motor Co. awarded the contract for the construction of a 3 story, 103 x 178 ft. garage on 38th St. and Dixie Highway. Estimated cost $120,000.

Ill., Chicago—A. I. Epstein, 712 West Madison St., awarded the contract for the construction of a 1 story garage at 18-24 South Sangamon St. Estimated cost $60,000.

Ill., Chicago—H. Jones, c/o D. Mahaffey, Archt., 118 North La Salle St., awarded the contract for the construction of a 1 story, 50 x 100 ft. machine shop at 1647-49 Fulton St. Estimated cost $20,000.

Ill., Chicago—Leichenko & Esser, Archts., 38 South Dearborn St., are receiving bids for the construction of a 2 story, 25 x 100 ft. automobile sales and service station at 6618 Cottage Grove Ave. for J. W. Lederer, c/o Architect. Estimated cost $50,000.

Ill., Chicago—Minchin, Spitz & Co., Archts., 19 West Jackson St., are receiving bids for the construction of a 1 story, 50 x 125 ft. garage on Division St. near Spaulding St. for J. Greenburg, c/o Architect. Estimated cost $40,000.

Ill., Chicago—A. D. Schuller, 4634 North Kedzie Ave., awarded the contract for the construction of a 1 story, 125 x 200 ft. automobile sales station and garage at 3016-32 Lawrence Ave. Estimated cost $60,000. Noted June 14.

Ind., Huntington—The Orton-Steinbrenner Co. awarded the contract for the construction of a 1 story, 100 x 240 ft. machine shop. Estimated cost $80,000.

Ind., Indianapolis—The Chandler & Taylor Co., 2053 South Addison St., is having plans prepared for the construction of a 1 story, 90 x 252 ft. factory for the manufacture of small engines. Estimated cost $27,000. Private plans.

Ind., Washington — The Leonard Range Co. plans to build a 1 story plant for the manufacture of stoves and ranges. Estimated cost $100,000.

Ia., Centerville—G. Morris awarded the contract for the construction of a 1 story, 40 x 60 ft. garage. Estimated cost $75,000.

Ky., Louisville—The Public Garage, 4th St., awarded the contract for the construction of a 1 story, 150 x 150 ft. addition to garage. Estimated cost $50,000.

Ky., Owensboro—Owensboro Clay Products Co., c/o J. A. Bolger, plans to build a machine shop in connection with new brick plant and power house. Estimated cost $25,000.

Ky., Paducah — The Tymo Utility Co. plans to build a plant for the manufacture of furnaces and parts. Estimated cost $40,000. Engineer or architect not selected.

Md., Baltimore—The Baltimore & Ohio R. R., Charles and Baltimore Sts., is having plans prepared for the construction of a 3 story pattern shop and office building on Mt. Clare St. Estimated cost $75,000. M. L. Kimball, Engr.

Mass., Boston — The city, Public Wks. Dept., will soon award the contract for the construction of a 2 story, 53 x 220 ft. garage and boiler room, with 31 x 65 ft. ell, on Albany St. Estimated cost $150,000. Mulhall & Holmes, 248 Boylston St., Boston, Archts. Noted Apr. 12.

Mass., Boston—The Edison Electric Illuminating Co., 39 Boylston St., has had plans prepared for the construction of a 1 story, 25 x 55 ft. addition to substation to be used as a machine shop at 99 West Canton St. Estimated cost $25,000. Bigelow & Wadsworth, 3 Hamilton Pl., Boston, Archts.

Mass., Cambridge (Boston P. O.)—C. Baratta, 263 Atlantic Ave., Boston, awarded the contract for the construction of a 1 story, 50 x 115 ft. garage on Carleton St., here. Estimated cost $60,000.

Mass., Cambridge (Boston P. O.)—F. Callahan, 665 Cambridge St., awarded the contract for the construction of a 1 story, 77 x 150 ft. garage on Baldwin St. Estimated cost $78,000.

Mass., Monson — The Rubwood Wheel, Inc., c/o H. N. Atwood, awarded the contract for the construction of a 2 story, 50 x 80 ft. factory for the manufacture of automobile wheels. Estimated cost $60,000.

Mass., Walpole—The Trustees of the Norfolk County Agricultural School have had plans prepared and will soon receive bids for the construction of a 1 story, 70 x 100 ft. machine shop. Estimated cost $20,000. W. Chapman, 15 Ashburton Pl., Boston, Archt.

Mich., Detroit—The C. M. Hall Lamp Co., 1035 East Hancock Ave., awarded the contracts for the construction of structural steel and mason work of a 2 story, 80 x 172 ft. addition to its lamp factory. Estimated cost $50,000 and $75,000 respectively. Noted May 24.

Mich., Detroit—The Hall-Dodds Co., 2526 Grand River Ave., awarded the contract for the construction of a garage, service station and sales room on Grand River and Brooklyn Aves. Estimated cost $125,000.

Mich., Detroit—The Paige Detroit Motor Co., Fort St. and McKinstry Ave., awarded the contract for the construction of a 1 story, 280 x 988 ft. automobile assembly plant on Warren Ave.

Mich., Detroit—The P. Smith Heater Co., 7595 Mt. Elliott St., awarded the contract for the construction of alterations and additions to its plant, consisting of a 2 story office building, 1 story addition to factory and storage vaults, on Hamilton St.

Mo., Kansas City — The Kansas City Light & Power Co., 1433 Grand Ave., is having plans prepared for the construction of a warehouse and garage, 100 car capacity, on 19th and Campbell Sts. Cost will exceed $25,000. Private plans.

Mo., Kansas City—The United Motor Service Co., 1416 McGee St., awarded the contract for the construction of a 1 story, 100 x 100 ft. sales room and garage. Estimated cost $50,000.

Mo., St. Louis—The Great Western Smelting & Refining Co., 2100 North Bway, awarded the steel and general contracts for the construction of a 1 and 2 story, 100 x 400 ft. steel foundry. Estimated cost $150,000. Noted June 7.

Mo., St. Louis—The Keller Sign Co., 900 North Bway, awarded the contract for the construction of a 2 story, 50 x 120 ft. metal sign factory and office building on Washington St. Estimated cost $40,000.

N. Y., Albany—P. McNamee, 90 State St., plans to build a 2 story garage, storage and service station at 89-95 Central Ave. Cost between $125,000 and $135,000.

N. Y., Binghamton — The Dunn-Cooper Corp., Madison Ave. and Water St., manufacturer of machine patterns, plans to build a large addition to its plant.

N. Y., Brooklyn—B. A James, c/o B. Driesler, Engr. and Archt., 153 Remsen St., will soon receive bids for the construction of a 100 x 200 ft. garage on Empire Blvd. Estimated cost $75,000.

N. Y., Buffalo—The Buffalo Genl. Electric Co., Electric Bldg., plans to build a 2 story, 120 x 200 ft. garage at 990 Niagara St. Estimated cost $100,000.

N. Y., Elmira—The Melvin Garage, High and Water Sts., plans to build a garage and service station. Estimated cost $55,000. Engineer or architect not announced.

O., Cleveland—K. V. Painter, 6521 Euclid Ave., awarded the contract for the construction of a 1 and 2 story, 50 x 140 ft. garage and show room on East 66th St. north of Euclid Ave. Estimated cost $50,000.

O., Ravenna—The A. C. Williams Co., manufacturer of house furnishings and toys, plans to build a moulding room, cupola, cleaning room, etc.

Okla., Okmulgee—The X. R. Gill Co. and Smith & Senter, Archts., 401 Commerce Insurance Bldg., are receiving bids for the construction of a 3 story, 75 x 118 ft. garage. Estimated cost $125,000. Noted May 10.

Tenn., Jackson—The Illinois Central R.R., Hibernia Bldg., New Orleans, La., will build improvements and additions to its yards, terminals, repair shops, compression plant, etc., here. Estimated cost $250,000. W. T. Atwill, Genl. Supt.

Tex., Lufkin — The Lufkin Machine & Fdry. Co. has had plans prepared and will soon receive bids for the construction of a 46 x 200 ft. machine shop. Estimated cost $40,000. Private plans.

Wis., Antigo—The Kelley Auto Sales Co. plans to build a 2 story garage and repair shop on Edison St. Estimated cost $40,000. Engineer or architect not selected.

Wis., Benton—The Kistler-Stephens Co., Platteville, is having plans prepared for the construction of a 2 story, 60 x 95 ft. zinc mill, here. Estimated cost $50,000. C. Lawyer, Benton, Engr.

Wis., Madison—The Madison Ford Garage, 210 East Washington Ave., is having plans prepared for the construction of a 1 story, 60 x 87 ft. garage. Estimated cost $40,000. Small & Fladd, Ellsworth Bldg., Madison, Archts.

Wis., Manitowoc—The Invincible Metal Furnace Co., 26th and Franklin Sts., awarded the contract for the construction of a 1 story, 85 x 185 ft. factory for the manufacture of metal furniture. Estimated cost $40,000.

Wis., Wisconsin Rapids—The Prentiss-Wabers Mfg. Co., Spring St., has had plans prepared and will soon receive bids for the construction of a 1 story, 45 x 142 ft. and 47 x 60 ft. factory for the manufacture of automobile camp stoves. Estimated cost $45,000. Wisconsin Eng. & Const. Co., 315 Jefferson St., Wausau, Engrs. Noted Jan. 4.

Ont., Hamilton—The Canadian Westinghouse Co., Traders Bank Bldg., Toronto, is having plans prepared for the construction of a 2 or 3 story addition to its factory for the manufacture of electrical machinery, here. Estimated cost $1,250,000. B. H. Prack, 50 Bay St., Toronto, Archt. Noted May 3.

Ont., Toronto—The City Dairy Co., Ltd., Spading Crescent, awarded the contract for the construction of a 4 story, 80 x 100 ft. garage on Bancroft St. Estimated cost $160,000.

Ont., Toronto—The Toronto Transportation Comn., 35 Yonge St., awarded the general contract for the construction of 1 story, 135 x 285 ft. car barns and repair shops and a 2 story, 42 x 118 ft. office building on Roncesvalles and Queen Sts. for about $300,000. Total estimated cost $750,000. H. H. Couzens, Mgr.

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